

**THE RELATIONSHIP BETWEEN  
CONTEXTUAL PROCESSING,  
INTRUSIVE IMAGERY AND  
HALLUCINATION-PRONENESS**

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## **Overview**

This thesis consists of three parts. Part 1 is a systematic review of literature centred on the relationship between hallucinations and mental imagery. The 24 studies reviewed highlighted the conceptual and methodological difficulties researchers have faced when investigating a relationship between mental imagery and hallucinations. Accordingly, inconsistent findings were demonstrated in studies that investigated a relationship between volitional imagery and hallucinations. However, the review did indicate a relationship between intrusive imagery and hallucinations. The nature and direction of this relationship, however, still remains theoretical. Part 2 is an empirical paper reporting on an investigation into one particular theory regarding the relationship between intrusive imagery and hallucinations. Accordingly, hallucinations were argued to be on an extreme end of a continuum with intrusive imagery. A particular type of information processing (weak allocentric and intact egocentric) was argued to underlie this relationship. The results of the study demonstrated some support for this thesis but further research was recommended. Part 3 is a critical appraisal of both part 1 and part 2 of the thesis. It reflects on two underlying theoretical assumptions of the research: The continuum approach to psychotic experiences; and the notion of trauma as a causal factor in the development of psychotic symptoms. In addition, conceptual and methodological issues with regard to measuring both hallucinations and intrusive image were discussed.

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## **Part 1: Literature Review**

# **The relationship between hallucinations and mental imagery**

## **Abstract**

### **Aims**

Despite over a century of theorising and empirical testing, the relationship between hallucinations and mental imagery remains unclear (Bentall, 1990). Consequently, this systematic review of the literature on hallucinations and mental imagery aimed to investigate whether a relationship exists between these two constructs, and, if so, what theoretical accounts can be supported.

### **Method**

A systematic review of the literature was conducted on Psychinfo and Medline databases on research investigating the relationship between hallucinations and mental imagery. This search strategy yielded 24 studies to be reviewed.

### **Results**

The research was divided into two broad sections: The relationship between volitional imagery and hallucinations and the relationship between intrusive imagery and hallucinations. In both clinical and non-clinical populations, the findings were inconsistent when investigating volitional imagery and hallucinations. A more positive relationship was consistently demonstrated between intrusive imagery and hallucinations. However, conclusions are limited due to methodological critiques.

### **Conclusions**

As a result of the inconclusive nature of the research on volitional imagery and hallucinations, it was concluded in line with Bentall (1990) that the existing research does not support an association. There were more positive findings in the area of intrusive imagery and hallucinations. Theoretical explanations and clinical implications for this potential association are discussed.

## **Introduction**

Although hallucinations have been demonstrated in physical disorders (Assad & Shapiro, 1986), a range of psychological disorders (e.g. Brewin & Patel, 2010) and in the general population (e.g. Barrett & Etheridge, 1992), they have predominantly been reified as a primary symptom of schizophrenia. Specifically, the symptoms of schizophrenia as defined by the Diagnostic and Statistical Manual of Mental Disorders IV include hallucinations, delusions and disorganised speech (APA, 1994). Many researchers have attempted to explain the nature of hallucinatory experiences (e.g. Bentall, 1990). One such theory centres on the relationship between mental imagery and hallucinations. However, the nature of this relationship remains unclear (Bentall, 1990). This review aims to investigate the relationship between hallucinations and mental imagery, in order to clarify the literature and highlight theoretical accounts that might account for this relationship.

## **Definitions of mental imagery and hallucinations**

The construction of mental imagery has dramatically evolved since Galton (1883) first attempted to address the nature of the phenomenal experience. Subsequently, Richardson (1967) defined mental imagery as quasi-sensory and quasi-perceptual experiences, of which we are self-consciously aware. Following the rise of cognitive psychology in the 1960's, mental imagery came to be viewed as both a phenomenal experience and an internal representation of perceptual objects, events or scenes (Richardson, 1999). As such, mental images occur in different forms, such as dreams and fantasies (Horowitz, 1967), or enter non-volitionally into conscious awareness (Horowitz, 1970). They can also possess the full range of sensory attributes, although the vast majority of the literature concerns visual imagery (Kosslyn, 1994).

With regard to a definition of hallucinations, Slade and Bentall (1988) proposed the following, broad definition: “Any percept-like experience, which (a) occurs in the absence of an appropriate stimulus, (b) has the full force or impact of the corresponding actual (real) perception and (c) is not amenable to direct and voluntary control by the experiencer” (p.23).

### **Theories of a relationship between mental imagery and hallucinations**

One of the oldest theories proposed that individuals with particularly vivid mental imagery would be prone to experience hallucinations (Galton, 1883). Indeed, in their formulation of hallucinations, Roman and Landis (1945) postulated that, “they might be thought of as mental images which become more vivid and compelling than ordinary imagery, but remain images nonetheless” (p. 327). Similarly, Strauss (1969) argued that hallucinations exist on a continuum with mental imagery.

Following this line of enquiry, it has been hypothesised that hallucinations arise due to difficulties in discriminating between a mental image and an actual perception (e.g. Aleman, Bocker & de Haan, 1999). This is based on the work of Kosslyn (1994) who argued that mental images like hallucinations have perceptual qualities and can occur in the absence of sensory stimuli. In determining whether a mental event is externally or internally generated (i.e. a perception or an image) an individual compares the amount of sensory, contextual and semantic attributes of the item (Johnson & Raye, 1981). Therefore, it has been proposed that greater imagery vividness or reduced perceptual clarity may create the conditions for hallucination formation (Bocker et al., 2000).

Horowitz (1975) presented an alternative thesis that individuals prone to hallucinations might demonstrate an imagery deficit, causing them to misattribute vivid images to an external source. As such, there have been attempts to address the relationship between the sensory modality of both imagery and hallucinations (e.g. Heilbrun, Blum & Hass, 1983).

Most recently, some authors have proposed theories based on a relationship between intrusive imagery and hallucinations. Although intrusive imagery is the hallmark of a posttraumatic stress disorder (PTSD) diagnosis, blurred boundaries exist between PTSD and other psychological disorders, especially psychosis (Mueser, 2010). This may be due to the high levels of trauma experienced by individuals diagnosed with psychosis (Read et al., 2005), as well as the phenomenological similarities between both intrusive imagery and hallucinations. (Nayani & David, 1996).

A number of theoretical accounts have been proposed to explain an association between intrusive imagery and hallucinations. Morrison (2001) argued that hallucinations represent culturally unacceptable interpretations of intrusive mental events. Hoffman (1986) and Hemsley (1993) postulated that hallucinations arise from the intrusion of unexpected material from long-term memory caused by deficits in temporal and spatial processing of information. Continuing an information processing account, Steel, Fowler and Holmes (2005) argued that hallucinations might arise as a result of weak encoding of contextual information. This is based on theoretical accounts of intrusive imagery in PTSD (Brewin, 2001). As such, intrusive memories from traumatic events appear into consciousness involuntarily, contain the sensory and emotion characteristics of the event but lack the temporal, verbal and



contextual information, to help make sense of the experience. They argued that these intrusive images form the template of hallucinatory experiences.

### **Previous reviews**

There have been two previous reviews investigating a relationship between imagery and hallucinations. Bentall (1990) reviewed psychological research that has attempted to explain the nature of hallucinations; imagery was one aspect of this review. Seal, Aleman and McGuire (2004) reviewed only research investigating a relationship between auditory hallucinations and imagery. Whilst Bentall (1990) argued that the research was inconclusive, Seal, Aleman and McGuire (2004) argued that hallucination formation is influenced by a greater role of imagery in determining a perception.

### **Aims of the review**

This review is centred on the relationship between mental imagery and hallucinations. The aim is to summarise the evidence to help clarify the nature of this proposed relationship. Consequently, the current review will provide an update to Bentall (1990) and include studies in all sensory modalities in order to complement the review by Seal, Aleman and McGuire (2004).

The current review will aim to answer the following questions:

1. Are hallucinations related to mental imagery?
2. If so, what theoretical accounts can explain the nature of this relationship?

Through answering these questions, it is hoped this will generate further areas of investigation in order to enhance understanding and help develop psychological interventions for individuals distressed by psychotic phenomena.

## **Methodology**

A comprehensive search of the literature was conducted on both Psychinfo and Medline databases in order to identify published papers within the area of imagery and hallucinations.

### **Search strategy**

Combinations of the following search terms were utilised: *hallucinations*, *hallucination*, *hallucinatory*, *psychosis*, *psychotic*, *schizophrenia*, *schizotypy*, *schizotypal*, *imagery*, *intrusion*, *intrusions*, *intrusive imagery*. This search strategy yielded 365 articles.

### **Additional Search**

Manual searches of the references of relevant articles yielded an additional 10 articles.

### **Inclusion criteria**

In order to be included in the review, articles needed to meet inclusion criteria.

Firstly, articles needed to have quantitative methodologies employing experimental or non-experimental designs. Secondly, articles had to be published in peer-reviewed journals written in the English language. Thirdly, the study designs employed measures that assessed both mental imagery and hallucinations. These could include

predisposition to hallucination or schizotypy measures, which include scales assessing hallucinatory experiences.

### **Exclusion Criteria**

Articles were excluded on the basis of the following criteria: Single-case studies; book chapters or viewpoint articles; studies where the focus of a relationship between imagery and hallucinations was neurobiological; studies on PTSD (and other psychological disorders), whereby intrusive re-experiencing images were not assessed or reported in relation to hallucinatory experiences.

On the basis of these inclusion and exclusion criteria, this search strategy yielded 24 studies to be reviewed.

### **Results - critical review**

The empirical research on imagery and hallucinations that is included in this review has been divided into two sub-categories (See Table 1):

1. The relationship between volitional imagery and hallucinations
  - 1.1 Studies employing introspective measures in clinical populations
  - 1.2 Studies employing introspective measures in non-clinical populations
  - 1.3 Studies employing objective measures in clinical and non-clinical populations
2. The relationship between intrusive imagery and hallucinations

**Table 1** *Studies investigating the relationship between mental imagery and hallucinations*

Paradigm	Study	Participants	Methodology	Findings
Volitional imagery and hallucinations: introspective measures in clinical populations	Mintz & Alpert (1972)	20 Hal SZ 20 Non Hal SZ 20 Controls	The WC task assessing vividness of mental imagery	Hal SZ group reported higher rates of imagery vividness
	Slade (1976)	8 Hal SZ 8 Non Hal SZ 16 Controls	Imagery assessed via the QMI, the Gordon and VTE	No difference between SZ groups. SZ groups together scored higher on imagery vividness than controls
	Brett & Starker (1977)	20 Hal SZ 20 Non Hal SZ 20 General medical patients	Imagery vividness assessed via presentation of cards Controllability assessed via the Gordon	No differences between any groups on imagery vividness or controllability Hal SZ group less vividness on emotional interpersonal items
	Starker & Jolin (1982)	67 Hal SZ - current 19 Hal SZ - historical 13 Non Hal SZ	Imagery vividness assessed via presentation of cards Vividness of daydreams assessed	No differences demonstrated between any of the groups
	Heilbrun, Blum & Hass (1983)	15 Hal SZ 9 Non Hal SZ	Participants reported vividness and sensory mode of 7 imagined events	Hal SZ group less preference for auditory imagery relative to visual
	Chandirami & Varma	20 Hal SZ	Imagery vividness	No difference between

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introspective  
measures in non-  
clinical populations

(1987)	20 Non Hal SZ 20 Controls	assessed via the QMI. Imagery control assessed via the Gordon	any of the groups regarding imagery vividness or control
Sack et al. (2005)	50 SZ 50 controls	Vividness of imagery and predisposition to hallucinations assessed via the QMI and the LSHS-R	The SZ group scored significantly higher on the LSHS-R and in all sensory modalities of the QMI compared to the controls
Oertel et al. (2009)	52 SZ 44 first-degree relatives 92 controls	All participants tested on the RHS and the QMI. Controls and relatives completed the German version of the SPQ	Greatest imagery vividness demonstrated in the relatives. Lowest imagery vividness in low Szt group. No difference between patients and high Szt group
Barrett (1993)	62 psychology students divided into 2 groups: 31 Hal students 31 Non Hal students	Groups created via scores on VHQ. Vividness of imagery assessed via the QMI	Hal group reported significantly more vivid imagery than the Non-Hal group
Barrett & Caylor (1998)	24 high scorers on VHQ 20 Hal SZ	The two groups compared on the reality characteristics of their hallucinations	No difference between groups on first hallucination. For most recent hallucination, students rated their image as more public and voluntary than SZ group

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clinical and non-  
clinical populations

Merckelbach & van der Ven (2001)	14 Hal students (if they indicated hearing “White Christmas”) 30 Non Hal students (original pool of 47)	Hallucinatory experience measured via WC test, the QMI used to assess imagery vividness. Hallucinatory predisposition, fantasy proneness and social desirability assessed via the LSHS, CEQ and SDS	No difference between groups on imagery vividness or social desirability. Hal group scored significantly higher on CEQ and LSHS. CEQ independent predictor of hallucinatory reports
Van der Ven & Merckelbach (2003)	38 students Hal (if they indicated hearing “White Christmas”) 70 students Non Hal (original pool of 111)	Hallucinatory experience measured via the WC test The QMI used to assess imagery vividness Hallucinatory predisposition, fantasy proneness, social desirability and Szt assessed via the LSHS, CEQ, SDS and STA	The Hal group scored higher on the QMI and the CEQ with the CEQ an independent predictor of hallucinatory reports
Bell & Halligan (2010)	46 high Szt 43 low Szt	Szt assessed via the O-LIFE and vividness of imagery assessed via the VVIQ	No difference in imagery vividness between Szt groups
Aleman, Bocker & de Haan (1999)	26 Students high LSHS 31 Students low LSHS (original pool of 74)	Vividness of imagery assessed via the QMI and objective measures. Predisposition to	No differences between high and low LSHS group on objective measures. High LSHS group

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	Aleman et al. (2000)	19 Students high LSHS-R 17 Students low LSHS-R (original pool of 243)	Vividness of imagery assessed via the QMI and VVIQ. Objective measures assessed imagery vividness and perception-imagery interaction. Predisposition to hallucinations assessed via the LSHS-R	High LSRS-R group reported significantly more vivid images as rated on the VVIQ but not QMI. No difference on 5 out of 6 objective measures. The high LSHS group demonstrated greater imagery-perception differences
	Bocker et al. (2000)	13 Hal SZ 19 Non Hal SZ 14 Controls	Vividness of imagery and interaction between imagery and perception assessed using objective measures	No group differences on vividness of imagery however Hal SZ benefited less from their visual imagery in determining a perception
	Aleman et al. (2003)	22 Hal SZ 35 Non Hal SZ	Vividness of imagery and interaction between imagery and perception assessed using objective measures	No group differences regarding vividness of imagery. Severity of hallucinations was significantly correlated with the role of imagery on perception
	Jakes & Hemsley (1987)	24 “healthy” volunteers	Assessed hypnagogic and hallucination experiences via interview. Predisposition to	LSHS significantly associated with hypnagogic experiences but not hallucinations

Morrison & Baker (2000)	15 Hal SZ 15 Non Hal SZ 15 Controls	hallucinations assessed using the LSHS Participants were assessed on the DTQ and DVQ	The HAL SZ group experienced more intrusions than the other groups
Morrison et al. (2002a)	35 SZ	Participants asked about their experience of intrusive imagery	Significant majority reported intrusive imagery accompanying psychotic symptoms
Holmes & Steel (2004)	42 participants	Szt assessed via the O-LIFE. Participants recorded intrusive experiences following presentation of traumatic film	Szt correlated with reports of intrusive imagery. O-LIFE independent predictor of intrusion frequency
Gracie et al. (2007)	228 students	Participants completed the TLEQ, SRS-PTSD, LSHS	Positive relationship between intrusions and hallucinations
Marziller & Steel (2007)	50 participants on wait-list for trauma service (original pool of 174)	Participants completed the STA and PDS	Positive relationship demonstrated between Szt and intrusions
Steel, Mahmood & Holmes, (2008)	45 road-traffic survivors	Participants completed the O-LIFE and PDS	Positive relationship demonstrated between Unusual Experiences scale of O-LIFE and intrusions

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CEQ = Creative Experiences Questionnaire (Merkelback et al., 1998)

DTQ = Distressing Thoughts Questionnaire (Clark & de Silva, 1985)

DVQ = Distressing Voices Questionnaire (Clark & de Silva, 1985; Morrison & Baker, 2000)

Gordon = The Gordon Test of Imagery Control (Gordon, 1949)

Hal = Hallucinations

LSHS = Launay Slade Hallucination Scale (Launay & Slade, 1981)



LSHS-R = Revised Launay Slade Hallucination Scale (Bentall & Slade, 1985)  
O-LIFE = Oxford-Liverpool Inventory of Feelings and Experiences (Mason et al., 1995)  
PDS = Posttraumatic Stress Diagnostic Scale (Foa et al., 1997)  
QMI = Questionnaire upon Mental Imagery (Richardson, 1967)  
RHS = Revised Hallucination Scale (Morrison et al., 2002b)  
SDS = Social Desirability Scale (Crowne & Marlow, 1964)  
SPQ = Schizotypy Personality Questionnaire (Raine, 1991)  
SRS-PTSD = the Self-Report Scale-Post Traumatic Stress Disorder (Gracie et al., 2007)  
STA = Schizotypal Personality Scale (Claridge & Broks, 1984)  
SZ – Schizophrenia  
Szt – Schizotypy  
TLEQ = Traumatic Life Events Questionnaire (Gracie et al., 2007)  
VHQ = Verbal Hallucinations Questionnaire (Barrett & Etheridge, 1992)  
VTE = Verbal Transformation Effect (Warren & Gregory, 1958)  
VVIQ = Vividness of Visual Imagery Questionnaire (Marks, 1973)

## **1. The relationship between volitional imagery and hallucinations**

### *1.1 Studies employing introspective measures in clinical populations*

The following is a review of 8 studies assessing the relationship between volitional imagery and hallucinations using introspective measures in clinical populations.

Mintz and Alpert (1972) investigated whether vivid auditory imagery may be a necessary prerequisite for the experience of hallucinations. The study employed a quasi-experimental design with three groups of 20 participants: A “hallucinating schizophrenic” group; a “non-hallucinating schizophrenic” group; and a “non-psychotic” control group. The schizophrenia diagnosis and presence or absence of hallucinations was determined by reviewing the medical notes and psychiatrist confirmation. The groups were matched for age and sex. Vividness of auditory imagery was assessed using the Spanos and Barber (1968) “White Christmas” task, in which participants were asked to close their eyes and imagine listening to the words and music of the song “White Christmas”, which was not actually played. Following this, vividness of the imaginary song, as well confidence levels were rated.

The authors reported a significant difference between the groups; 17 of the “hallucinating schizophrenic” group reported that they heard the song being played (therefore described as having high auditory imagery) compared to 1 in the “non-hallucinating” group and 8 in the control group. The authors concluded that two conditions are necessary for the experience of auditory hallucinations: Vivid imagery and impaired reality testing.

An important critique of this experimental paradigm is that it may be demonstrating participant suggestibility or adherence to perceived demand characteristics of the experiment. Furthermore, the reliability and validity of introspective self-report data cannot be determined.

Slade (1976) investigated the psychological factors involved in the predisposition to auditory hallucinations. One aspect of this study centred on mental imagery as a predisposing factor. The study employed a quasi-experimental design with 2 small but well-matched groups of psychotic patients, differing only in whether auditory hallucinations were an aspect of their diagnosis. Both groups at the time of testing were not experiencing any psychotic symptoms. A control group was also formed consisting of participants with no history of mental illness.

Mental imagery was tested via the shortened Betts Questionnaire upon Mental Imagery (QMI; Richardson, 1967), which is a 35-item scale measuring volitional mental imagery in all sensory modalities. Visual imagery control was assessed via the Gordon Test of Visual Imagery Control (Gordon, 1949). Participants were also assessed on the “Verbal Transformation Effect” (VTE: Warren & Gregory, 1958) whereby a word was repeatedly presented and participants pushed a button if they think they heard a different word. The hypotheses were that the auditory hallucinations psychotic group (AH) in comparison to the non-auditory hallucination psychotic group (non-AH) and the control group would score higher on imagery vividness, have less imagery control and generate more alternative words on the VTE. The results demonstrated no difference in vivid imagery between the AH and

non-AH group. However, the psychotic groups together scored higher on imagery vividness than the control group.

The results were at variance with the findings of Mintz and Alpert (1972) who demonstrated a significant difference in imagery vividness between the AH and non-AH groups. Slade (1976) identified that Mintz and Alpert (1972) measured only auditory imagery vividness, whereas the QMI taps into six sensory modalities. Yet the Slade (1976) study only tested 8 participants in each psychotic group, which may have represented insufficient power to pick up any differences.

Following on from these studies, Brett and Starker (1977) investigated the hypothesis that an auditory hallucinations psychotic group (AH) would report greater imagery vividness and less imagery control than a non-AH psychotic group and a control group. Imagery vividness was tested via presentation of cards with items that the participants had to imagine. One of the items was the song “White Christmas” as used by Mintz and Alpert (1972). Other items included inanimate and emotional-interpersonal content. Participants were asked to rate the vividness of the auditory image on a 5-point scale. Imagery controllability was measured using the Gordon Test of Visual Imagery Control (Gordon, 1949).

Contrary to previous findings, no difference was found between any of the groups on imagery vividness or controllability. In fact, the only significant finding was that the AH psychotic group reported less vivid imagery than the control groups on emotional interpersonal items. The authors suggested a “discontinuous” model

whereby imagery processes are disrupted by emotion, reappearing in a more pathological form as a hallucination.

In sum, the first three studies reported contradictory findings. An important critique of these studies is that there was no clarity on the criteria used for diagnosis.

Similarly, it was not noted whether hallucinations were present or historical in either the hallucination or non-hallucination psychotic groups. As such, these issues call to question the reliability of the division of groups in these studies. In addition, the impact of anti-psychotic medication cannot be assessed and this may have had a significant impact on the findings.

In addressing some of the concerns with diagnostic criteria, Starker and Jolin (1982) examined volitional auditory imagery in psychotic and non-psychotic populations using more standardised criteria for schizophrenia and hallucinations. They hypothesised that an auditory hallucination (AH) psychotic group would demonstrate a deficit in imagery vividness and fantasy compared to a non-AH psychotic group. This was a quasi-experimental study and categorisation was based on the Feighner criteria (Feighner et al., 1972). Participants were then divided into 3 groups: currently hallucinatory (N=67); previously hallucinatory (N=19); and non-hallucinatory (N=13). The methodology was identical to Brett and Starker (1977), but the vividness, guilt and fear of failure in daydreams were also assessed via the Imaginal Process Inventory (Singer & Antrobus, 1972).

The results demonstrated no significant differences between any of the groups on any of the items. This finding is thus contrary to Mintz and Alpert (1972) who

demonstrated support for vivid imagery as a pre-requisite for hallucinations. The findings are also contrary to Brett and Starker (1977) who demonstrated less vivid imagery in the hallucinatory group.

A significant limitation of the study is the difference in the numbers of participants in each group. This was not commented upon by the authors, and it is possible that it affected the power of the study. Further, although a more standardised criterion was used to determine psychotic presentations, the criteria itself was based on an earlier classification system (DSM-III). In theory this system was less valid and reliable than the current one (DSM-IV). Furthermore, the authors did report significant differences in levels of anti-psychotic medication between the groups. This may have affected imagery vividness, especially in participants of the hallucinating group who were taking the highest levels of medication.

Following the finding of reduced imagery vividness in psychotic compared to non-psychotic populations (Brett & Starker, 1977), Heilbrun, Blum and Hass (1983) tested the hypothesis that hallucinations may reflect misrepresentations of images occurring in a non-preferred sensory mode. Accordingly, auditory hallucinations occur in people with less preference for auditory images. In addition, the authors investigated whether the non-preferred mode was accompanied by low levels of imagery vividness. Categorisation of groups was made on the basis of DSM-III criteria and hallucinating (N=15) and non-hallucinating (N=9) groups were formed. Participants were matched for age, sex and medication. The experimental paradigm was similar to that of Brett and Starker (1977) and Starker and Jolin (1982). In this instance, participants were asked to imagine 7 events (e.g. clapping hands) and report

the vividness and whether the image appeared to them in the visual or auditory mode. A second imagery measure was used whereby participants were instructed to evoke imagery ratings for both auditory and visual images.

The results demonstrated that patients with auditory hallucinations showed less preference for auditory imagery relative to visual imagery. However, they did not demonstrate that this was connected to a reduction in the vividness of imagery. Similar to previous studies, categorisation was based on DSM-III criteria, which raises questions as to the reliability of the group differences. Moreover, the size of each groups were very small, thus increasing type-1 error probability.

Based on the proposal that mental imagery and perceptual processes are closely linked and interdependent, Chandirami and Varma (1987) investigated vividness and control of volitional mental imagery in schizophrenic participants and normal controls. The study employed a quasi-experimental design with 20 participants in 3 groups: A hallucinating schizophrenic group, a non-hallucinating schizophrenic group and a control group. Group selection was made on the basis of the Feighner criteria (Feighner et al., 1972) and the study was carried out in India. Participants' mental imagery was assessed via the modified Betts Vividness of Imagery Questionnaire (QMI; Sheehan, 1967) and the Gordon's Test of Visual Imagery Control (Gordon, 1949).

The authors found no significant difference in vividness of mental imagery or control of imagery between any groups in any modality. However, there are potential limitations around the cultural specificity of the measures.

Similarly, Sack et al. (2005) investigated the vividness of mental imagery and hallucinations in a group of 50 patients with a diagnosis of paranoid schizophrenia, and 50 age and sex-matched controls in Germany. A translated version of the Betts QMI was used to assess the vividness of mental imagery in seven sensory modalities. Predisposition to hallucinations was assessed using a translated Launay and Slade scale (LSHS-R; Bentall & Slade, 1985).

Results demonstrated that there was no correlation between the QMI and LSHS-R in either of the two groups. However, the schizophrenia group scored significantly higher on the LSHS-R and in all sensory modalities of the QMI as compared to the controls.

Thus it was concluded that the paranoid schizophrenia group experienced greater vividness of mental imagery as compared to the control group. The lack of a correlation between the QMI and the LSHS-R may have been due to the fact that the QMI is a measure of volitional imagery vividness whereas the LSHS-R taps into more intrusive experiences. Therefore, it seems that these two quite different aspects of imagery may not be linked. A further critique is that the measures were interpreted to German. As such, it is unknown to what extent cultural and language differences may have impacted on the results.

Oertel et al. (2009) investigated mental imagery vividness as a trait marker of psychosis, rather than hallucinations per se. Participants were 52 patients with a diagnosis of paranoid schizophrenia, 44 first-degree relatives, and 92 healthy controls. All participants were tested on the Revised Hallucination Scale (RHS:



Morrison et al., 2002b), which is based on the LSHS-R (Bentall & Slade, 1985) and the QMI (Sheehan, 1967). Controls and relatives completed the German version of the Schizotypy Personality Questionnaire (SPQ: Raine, 1991). Psychometric tests were also carried out, though are not relevant to this review.

The results demonstrated a significant difference in QMI scores between the groups. Post hoc analysis demonstrated greatest imagery vividness in the relatives, the lowest vivid imagery in the low schizotypy group, whilst patients and the high schizotypy group were in the middle. No difference was demonstrated between patients and high schizotypy controls. Furthermore, patients scored significantly higher on the RHS than all other groups and no correlation was demonstrated between the QMI and the RHS. Imagery vividness was also independent of current psychopathology.

Consequently, the authors concluded that mental imagery and predisposition to hallucinations are independent of each other. In accordance with Sack et al. (2005), they argued that imagery vividness is more related to the schizophrenia spectrum than to hallucinations per se.

An important critique of this study was proposed by Bell and Halligan (2010), who argued that the comparison between high and low schizotypy controls relied on a relatively small sample (N=24 in each), which may have affected power. They completed a similar study, described in the next section.

### *1.2 Studies employing introspective measures in non-clinical populations*

The following is a review of 5 studies assessing the relationship between volitional imagery and hallucinations using introspective measures in non-clinical populations.

Barrett (1993) investigated the relationship between self-rated verbal hallucinations and vividness of imagery. 62 psychology students (out of original pool of 131) who had completed the Verbal Hallucinations Questionnaire (VHQ: Barrett & Etheridge, 1992) were divided into two groups: Hallucinators and non-hallucinators. The questionnaire consisted of items in which individuals could report hearing their name called when no one was there, or hearing the voices of absent friends or relatives. Participants were also tested on the Betts QMI Vividness of Imagery Scale (Richardson, 1967).

The main finding was that the hallucinating group reported significantly more vivid imagery than the non-hallucinating group. As such, Barrett concluded that, “hallucinations are images misidentified by the reality discrimination process as perceptions” (p.66). This finding provides support for the notion that vivid imagery plays a role in the genesis of hallucinations. However, an alternative hypothesis might be that responses on the VHQ tap into hypnagogic or drug-induced experiences rather than true hallucinations.

In addressing this issue, Barrett and Caylor (1998) investigated whether hallucinations in the general population are veridical accounts of hallucinations or whether they are daydreams or vivid images. In doing so, they assessed the reality characteristics of hallucinatory-type experiences and “true” hallucinations. 250 college students completed the Verbal Hallucination Scale (VHS: Barrett &

Etheridge, 1992). On a questionnaire that assessed the reality characteristics of hallucinations, the 24 highest scores on the VHS were compared with the hallucinations of 20 participants with a diagnosis of schizophrenia. Items on the questionnaire tapped into characteristics of sensation, publicness, objectivity and independence. The authors found that 50% of students reported experiencing their hallucination as having all the characteristics of a perceptual event. Furthermore, they found no significant difference between the groups on any of the reality characteristics for the first verbal hallucination. For the most recent hallucination, students rated their image as significantly more public and voluntary than the schizophrenia group.

As a result of these findings the authors concluded that instances of hallucinations in the general population contain the necessary characteristics to classify them as hallucinations. Furthermore, the finding that hallucinations in clinical populations do not always contain the full characteristics of a perception adds some weight behind the notion that hallucinations may be on a continuum with vivid mental imagery.

Despite these results, Merckelbach and Van der Ven (2001) attempted to address whether reports of “hallucinations” may at times represent a particular response bias demonstrated by fantasy-prone individuals. They defined fantasy-proneness as a deep and profound involvement in fantasy and imagination (Lynn & Rhue, 1988). It has been demonstrated that fantasy-prone individuals have a tendency to endorse odd items (Merckelbach et al., 2000). The authors recruited 47 students who were assessed on the “White Christmas” test, the QMI (Sheehan, 1967), the Social Desirability Scale (SDS; Crowne & Marlow, 1964), the Launay-Slade Hallucination

Scale (LSHS; Launay & Slade, 1981), and the Creative Experiences Questionnaire (CEQ; Merckelbach et al., 1998). The CEQ is an index of fantasy-proneness comprising 25 dichotomous items such as, “in general, I spend at least half of the day fantasizing or day-dreaming”, and “my fantasies are so vivid that they are like a good movie”. Following testing, two groups were created: A hallucination group, which consisted of 14 out of 44 participants who indicated that they heard the song on the “White Christmas” paradigm, and a non-hallucinating group of the remaining participants.

The results demonstrated that the groups did not differ on measures of imagery vividness or social desirability. However, the hallucination group scored significantly higher on the CEQ and LSHS than the non-hallucination group. On a logistical regression analysis, the CEQ was the only predictor of hallucinatory reports. The authors concluded that the “White Christmas” paradigm may not be indicating a predisposition to hallucination, but rather a tendency to endorse odd items. However, they recognised an alternative interpretation that fantasy-proneness might drive impaired reality testing leading to hallucinatory reports. Limitations of the study include the use of quite a small sample of participants and they used the original LSHS scale, which has been found to be less reliable than revised scales (Bentall and Slade, 1985).

Consequently, van de Ven and Merckelbach (2003) replicated and extended the study through increasing the sample size and using two scales measuring schizophrenia-like phenomena. In this study, 111 participants completed the “White Christmas” task and were assessed on the Schizotypal Personality Scale (STA;

Claridge & Broks, 1984), the LSHS (Launay & Slade, 1981), the QMI (Sheehan, 1967), and the CEQ (Merkelbach et al., 1998). 38 out of 108 participants who completed the study reported hearing the White Christmas song being played when it was not, thus suggesting they had a “hallucinatory-like” experience. The study demonstrated that individuals in the “hallucinatory” group scored significantly higher on the QMI and the CEQ, with the CEQ emerging as the greater predictor variable on a linear regression. The two groups did not differ on the LSHS or the STA.

The authors concluded that the findings replicate those of Merckelbach and van de Ven (2001), in that fantasy-proneness may reflect an impaired reality testing that precipitates misattribution of internal events to external sources. However, as the authors suggested, it may be that fantasy-prone individuals have a tendency to endorse odd items. Therefore, the White Christmas task and other introspective measures may be tapping into a response bias rather than actual hallucinatory experiences.

Bell and Halligan (2010) compared high (N=46) and low (N=43) schizotypes as measured on the O-LIFE (Mason et al., 2005) with scores on the Vividness of Visual Imagery Questionnaire (VVIQ: Marks, 1973). Contrary to Oertel et al. (2009), the authors found no group differences in vividness of imagery between the schizotypy groups. In comparison to the study by Oertel et al. (2009), both used different measures of schizotypy. Further, Oertel et al. (2009) employed the QMI, which assesses vividness of imagery in 7 sensory modalities, whilst Bell and Halligan (2010) used the VVIQ, which only assesses visual imagery.

### *1.3 Studies employing objective measures in clinical and non-clinical populations*

As highlighted, the inconsistencies in the studies above may be due to limitations such as limited criteria used to define the groups, small sample sizes or unknown influence of neuroleptic medication. Furthermore, introspective measures such as the “White Christmas” task may lack construct validity in determining hallucinatory reports, and instead may reflect a response bias to endorse odd items (e.g. Merckelbach & van de Ven, 2001). Consequently, a number of researchers have attempted to study the relationship between imagery and hallucinations though employing what they term as “objective” measures. The following is a review of 4 studies employing such objective measures in clinical and non-clinical populations.

Aleman, Bocker and de Haan (1999) tested the hypothesis that greater imagery vividness would be related to reports of hallucinations due to greater difficulties in discriminating between an image and a percept. This is based on the work of Kosslyn (1994) that mental images like hallucinations have perceptual qualities and can occur in the absence of sensory stimuli. In determining whether a mental event is externally or internally generated (i.e. a perception or an image), an individual compares the amount of sensory, contextual and semantic attributes of the item (Johnson & Raye, 1981).

The authors employed a student population sample (N=74). The LSHS (Launay & Slade, 1981) determined hallucination predisposition and the Betts QMI (Richardson, 1967) measured vividness of imagery. In addition, participants were also tested on an objective measure of imagery vividness. This was done through the use of a task developed by Metha, Newcombe and de Haan (1992), which consists of

a perceptual and imagery condition. In the perceptual condition, a triad of line drawings were presented and participants selected the odd-one-out. In the imagery condition, only the names of the objects were read out, which meant that participants had to form mental images of the objects in order to make a discrimination. It was stated by the authors that the more vivid the images, the smaller the difference would be between the imagery and perceptual conditions.

The results demonstrated no significant main effects of imagery vividness and hallucinations. There was a significant interaction effect between group and measures but post hoc tests were not significant. Consistent with Barrett (1993), the authors did demonstrate a significant effect of greater self-reported imagery vividness and predisposition to hallucinations. However, the current study employed the original Launay-Slade Hallucination scale (Launay & Slade, 1981), which may be less reliable than the revised scale (Bentall & Slade, 1985).

Aleman et al. (2000) repeated the study by Aleman, Bocker and de Haan (1999) but added an additional introspective imagery questionnaire; the VVIQ (Marks, 1973), which is the visual subscale of the QMI but ratings are made with eyes open and closed. In addition, the authors included a number of additional objective tasks. An auditory task, similar to the visual task required participants to make a judgement of the odd item after presentation of either a triad of sounds or triad of descriptions. An imagery-perception interaction task was also included. On 25% of the trials, participants imagined the tone or letter to be recognised, another 25% of trials participants imagined a different tone or letter, and on the remaining 50% of trials no stimuli to be imagined were presented. The difference in the number of detected

stimuli in the “on-image” condition compared to the “off-image” condition was argued to be a measure of the interaction between imagery and perception. As such, a larger difference implies a greater effect of imagery, which was expected in participants with hallucinatory experiences according to the hypothesis that increased perceptual characteristics of mental images are associated with hallucinations.

Out of 243 undergraduate students who completed the LSHS-R, the 19 highest scorers and 17 lowest scorers were selected, thus forming 2 groups. The high LSHS-R group reported significantly more vivid images as rated on the VVIQ than the low group but not on the QMI. On the objective measures, the only difference found was on the visual object imagery task, whereby a larger difference between the imagery and perception performance was observed in the low LSHS-R group compared to the high group, thus indicating a decrease in perceptual characteristics of mental images. This finding was contrary to the authors’ hypotheses.

Bocker et al. (2000) employed a clinical population and also investigated whether hallucinations arise as a result of misinterpreting internally generated images as externally based perceptions. They generated two hypotheses: Either the vividness of a perception might become degraded, or the vividness of mental imagery might increase.

Participants were 32 psychiatric inpatients with a DSM-IV diagnosis of schizophrenia. Positive and negative symptoms were assessed using the Positive and Negative Symptom Scale (PANSS; Kay, Opler, & Fiszbein, 1987) regarding symptoms during the previous week. Lifetime experience of hallucinations was



assessed on the Comprehensive Assessment of Symptoms and History (CASH; Andreasen, 1987). Consequently, a hallucinating schizophrenic group was formed with 13 participants and a non-hallucinating group with 19 participants. This was based on the PANSS scores, and the two groups were also significantly different in the lifetime experiences of hallucinations. A control group was also formed (N=14) of participants with no history of mental health problems. They employed the task developed by Metha, Newcombe and de Haan (1992) as well as the interaction between imagery and perception task described above in the study by Aleman et al. (2000).

No group differences were demonstrated on the perception task or on the first test of imagery vividness. On the interaction test, group differences were not significant. However, a significant interaction was demonstrated between modality and task. The authors explained that the hallucinating group profited less from the overlap between the image with presented stimulus than the non-hallucinating patients. They also argued that the findings provided some evidence that hallucinations might be formed in individuals whose auditory images have more percept-like qualities. However, it seems that these conclusions need to be balanced with the insignificant group differences on most of the tasks.

Aleman et al. (2003) followed up the study by Bocker et al. (2000) but included a larger sample and more behavioural measures of imagery vividness. Accordingly, they investigated whether patients with and without hallucinations differ on tasks of imagery-perception relations. Further, they tested whether the severity of

hallucination would be related to an increased influence of imagery on perception (i.e. greater influencing of what they term as “top-down” processing).

57 patients with a diagnosis of schizophrenia were included in the study. DSM-IV diagnosis was made on the basis of the CASH and the PANSS. All except three were treated with atypical antipsychotics. 2 groups were formed: A hallucination group (N=22) and a non-hallucination group (N=35). Participants were tested on the same objective tasks as used by Aleman et al. (2000). In addition, the Topography of Voices Rating Scale (TVRS; Hustig & Hafner, 1990) was used to measure frequency, audibility, clarity and affective response to auditory hallucinations.

No between group differences were found on any of the measures. However, on the interaction task, the severity of hallucinations was significantly correlated with the role of imagery on perception. That is, patients with more severe hallucinations demonstrated a significant gain of imagery on perception. Therefore, they concluded that top-down processes may “override” bottom-up information in determining a percept. Although this is an interesting result, it needs to be evaluated in the context of it being a post-hoc finding and of there being no significant group differences.

## **2. The relationship between intrusive imagery and hallucinations**

All the aforementioned studies investigated a specific type of imagery, namely volitional imagery. The following 7 studies investigated intrusive imagery and its relationship with hallucinations.

Jakes and Hemsley (1987) interviewed 24 “healthy” volunteers on their hypnagogic experiences, hallucination experiences, and assessed imagery vividness on the Launay and Slade (1981) predisposition to hallucinations measure (LSHS). Hallucinations were defined by a response of “yes” to the question, “have you ever, while wide awake, had the experiences of, “seeing”, “hearing”, or “touching” a person or an animal who was not in fact really there” (p.765). They found that the LSHS was significantly associated with hypnagogic experiences but not hallucinations.

This study suggests that vivid imagery is related to hypnagogic rather than “true” hallucinatory experiences. However, a limitation of the study is that it used only 24 participants who were placed into groups based on their scores on the interview. The small sample size raises significant concerns about whether the study was adequately powered. Furthermore, The Launay and Slade (1981) measure was subsequently revised replacing a yes/no response with a Likert scale, which increased reliability and validity (Bentall & Slade, 1985).

Morrison and Baker (2000) investigated the role of intrusive mental events in the experience of auditory hallucinations. This is based on the theories of Hoffman (1986) and Hemsley (1993) that hallucinations arise from the intrusion of unexpected material from long-term memory. Morrison and Baker (2000) defined intrusions as automatic repetitive thoughts, images and impulses that are usually accompanied by affect (Rachman, 1981). They hypothesised that people with auditory hallucinations would experience more frequent intrusions and that these would be rated as more

distressing, uncontrollable and unacceptable in comparison to psychiatric patients without hallucinations and controls.

A hallucination group consisted of 15 patients who had a DSM-IV diagnosis of schizophrenia and who were currently experiencing auditory hallucinations. The mean age of the participants was 43.93 years and the group consisted of 11 males and 4 females. A non-hallucination group met DSM-IV criteria for schizophrenia but had not heard voices for at least 3 years. The mean age was 42.93 years with 12 males and 3 females. All participants in both psychiatric groups were being treated with neuroleptic medication. A non-psychiatric control group consisted of 15 participants who had never experienced auditory hallucinations. The mean age of this group was 38.73 years and there were 10 males and 5 females.

All participants completed the Distressing Thoughts Questionnaire (DTQ; Clark & de Silva, 1985) and the Distressing Voices Questionnaire (DVQ). The DTQ consists of 12 statements relating to intrusive thoughts or images and ratings of emotions and frequency on a 9-point likert scale. The DVQ was designed for this study and the authors substituted thought/image with the word, “voice”.

The results demonstrated that the hallucination group experienced more anxiety-related and depression-related intrusions than both the psychiatric and non-psychiatric controls. Further, the hallucination group found these intrusions to be more worrying and more difficult to remove.

The limitations of this study are, firstly, only 13 participants in the hallucination group completed the questionnaires, which questions whether the study was adequately powered. Secondly, the authors developed the DVQ for this study. The reliability and validity of this measure had therefore not been assessed. Nevertheless, the study does support the notion that intrusive contents of consciousness may be related to auditory hallucinations. However, the study does not inform of the relative contribution of intrusive imagery.

Consequently, Morrison et al. (2002a) investigated whether intrusive imagery is experienced in relation to psychotic symptoms. Participants were 35 patients with a diagnosis of a psychosis. Diagnosis was made on the basis of a clinical interview and case notes and checked against DSM-IV criteria. All patients were receiving cognitive therapy.

During the cognitive therapy, participants were asked about their experience of imagery that accompanied their psychotic symptoms. Further, a semi-structured interview was used to evoke the image and explore its content and meaning. Of the 35 participants, 74.3% identified an image in relation to their psychotic symptoms. Of these, 69.2% reported that their images were recurrent, 96.2% were able to link the image to an emotion, and 70.8% were able to associate the image with a particular event from the past. Consequently, it is hypothesised that similar to other psychological disorders, imagery may be involved in the maintenance of hallucinations and delusions.

Although previous studies have investigated imagery in relation to psychosis, this study was the first to assess whether individuals with psychosis have related intrusive imagery. Despite the positive findings, there are a number of limitations. Firstly, this was not an experimental study so the findings can only be used to form hypotheses to then test experimentally. Secondly, the participants were currently engaged in cognitive therapy. As such, they could represent a homogeneous population (i.e. those suitable for therapy) and their responses may reflect a bias to report what they felt the experimenter was looking for.

Based on preliminary findings of intrusive imagery being involved in psychotic experiences, Holmes and Steel (2004) employed an analogue design to investigate whether individuals who scored high in schizotypy (as compared to low scoring schizotypes) would demonstrate more intrusions following presentation of a traumatic film. 42 participants completed the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason et al., 1995) and, following presentation of a traumatic film of a road traffic accident, used a diary to record spontaneously occurring intrusions related to the film over the subsequent 7 days. Within a regression analysis, schizotypy was correlated with intrusion frequency and the Unusual Experiences scale of the O-LIFE was an independent predictor of intrusion frequency.

However, as this was an analogue study, the external validity of the findings remains questionable. Furthermore, the study relied on self-report of intrusions, which raises a potential fundamental issue. It is, for example, possible that individuals who are high in schizotypy (in particular the Unusual Experiences scale) may be more likely

to endorse odd items with regard to the situational demands of an experimental situation. This has been demonstrated in individuals high in fantasy-proneness, which is highly correlated with schizotypy (Meckelback et al., 1998). Furthermore, once such individuals are asked to report intrusive imagery, they may be more likely to attend to these unusual experiences. Therefore, the high schizotypal individuals may not be experiencing more intrusions but are perhaps more likely to notice, attend and report the intrusions they do have.

Similarly, Gracie et al. (2007) investigated whether re-experiencing symptoms (i.e. intrusive imagery) would be associated with the experience of hallucinations. 228 students completed the Traumatic Life Events Questionnaire (TLEQ), the Self-Report Scale-Post Traumatic Stress Disorder (SRS-PTSD), the LSHS (Bentall & Slade, 1985) and the Structured Interview for Assessing Perceptual Anomalies (SIAPA). Other measures were used but are not relevant to this review. The authors demonstrated that 88.6% of participants had experienced at least 1 trauma and 14.5% met the criteria for PTSD. Using a logistical regression with the LSHS as the dependant variable they demonstrated that the re-experiencing symptoms of PTSD (i.e. intrusive imagery) predicted hallucinations. However, the variability explained by the re-experiencing symptoms alone was relatively small (3%).

Consequently, the study suggests a correlation between intrusive imagery and hallucination predisposition but also highlights that other mechanisms may be involved. However, the study has a number of limitations. It employed a retrospective, cross-sectional, analogue design. Therefore, meditational factors are unknown and the external validity of the findings remains unknown.

Marziller and Steel (2007) investigated further the relationship between intrusions and schizotypy. Participants were patients at a trauma service who were seeking help for posttraumatic stress more than 1 month after the traumatic event. 50 out of 174 participants returned a series of questionnaires, which included the Schizotypal Personality Scale (STA; Claridge & Broks, 1984) and the Posttraumatic Stress Diagnostic Scale (PDS; Foa et al., 1997), which assesses the frequency of intrusions as well as the effect of PTSD symptoms.

The authors found a positive relationship between schizotypy and posttraumatic symptomatology and in particular the re-experiencing subscale of the PDS. The authors concluded that the study supports the notion of schizotypy as a vulnerability factor for traumatic intrusions. However, it is important to consider that this was a retrospective, cross-sectional design, and the response rate was fairly low.

In a similar study, Steel, Mahmood and Holmes (2008) investigated whether schizotypy was related to PTSD symptomatology. In this study, 45 individuals were interviewed between 7 and 31 days after a road traffic accident. Participants completed the O-LIFE, a measure of schizotypy (Mason et al., 1995), but only the Unusual Experiences subscale was included for analysis. The PDS (Foa et al., 1997) was also completed. Additional measures were administered but these are not relevant to this review.

Employing a multiple regression, the Unusual Experiences scale of the O-LIFE was significantly associated with the PDS. This is suggestive of a link between hallucinatory experiences and intrusive imagery. However, the results are limited by



the retrospective nature of the data and cross-sectional analysis. Furthermore, in this study, as well as in Marziller and Steel (2007), some participants may have been more inclined to endorse odd items and to complete and return the questionnaires. It is also possible that the experience of trauma itself influences the response on schizotypy scales. Accordingly, individuals experiencing flashbacks may be likely to score highly on questions pertaining to unusual experiences. As such, it may be that traumatic experiences are associated with schizotypy, or perhaps that the measures are not sensitive to the difference between flashbacks following a trauma and unusual experiences more related to hallucinations.

## **Discussion**

### **Summary of the literature**

The early studies exploring a relationship between imagery and hallucinations employed introspective measures in clinical populations. The results of these studies were fairly inconsistent. Some studies found greater vividness of imagery in hallucinating individuals compared to non-hallucinating clinical groups and controls (e.g. Mintz & Alpert, 1972). Other studies found that only clinical groups with a diagnosis of schizophrenia, regardless of the presence of hallucinations, demonstrated greater imagery vividness as compared to controls (e.g. Oertel et al., 2009; Sack et al., 2005; Slade, 1976). Some studies found no difference in imagery vividness between any groups (e.g. Chandrimani & Varma, 1987) or indeed less imagery vividness in a hallucinating group (Brett & Starker, 1977). Heilbrun, Blum and Hass (1983) demonstrated that people with auditory hallucinations show less preference for auditory imagery. However, rather than this process demonstrating a

theoretical account of hallucinations, it is quite possible that this represents an avoidance mechanism. As such, consciously producing visual representations may be less anxiety provoking.

A number of limitations to these studies were presented. In the earlier studies, insufficient categorisation may have affected the reliability of the groups, the small sample sizes, raised questions of whether studies were adequately powered. Furthermore, all of the studies using clinical populations did not assess the impact of neuroleptic medication.

Some of the more recent studies assessing imagery vividness and hallucinations have used general population samples based on the continuum hypothesis of psychotic-like experiences (Claridge, 1987). In some studies, enhanced imagery vividness was demonstrated in individuals with hallucinatory experiences (e.g. Barrett, 1993). On the other hand, Bell and Halligan (2010) demonstrated no difference in visual imagery vividness in high and low schizotypy groups.

The main critique of these studies centres on whether reports of hallucinatory experiences in the general population are veridical accounts of hallucinations. Barrett and Caylor (1998) demonstrated that hallucinations in the general population do contain the necessary reality characteristics to class them as “true” hallucinations. However, Merckelbach and van de Ven (2001) and van de Ven and Merckelbach, (2003) argued that some accounts of hallucinations might reflect a tendency to endorse odd items within an experimental paradigm.

To address some of the limitations of using introspective measures to assess imagery vividness, a number of researchers employed what they termed as “objective” measures. Results from these studies were mixed. Aleman, Bocker and de Haan (1999) and Aleman et al. (2000) on the whole did not find a relationship between imagery and hallucinations using the objective measures but did with the introspective measures. However, Aleman et al. (2000) contrary to their hypothesis, found that the hallucinating group reported using imagery less in determining a perception. Employing clinical populations, Bocker et al. (2000) and Aleman et al. (2003) did not find any significant differences between hallucinating and non-hallucinating groups on objective tests of imagery vividness. However, contrary to Aleman et al. (2000), both studies demonstrated a trend for patients with hallucinations to use imagery more in determining a perception. Based on the findings, it was argued that in individuals prone to hallucinations, imagery may play a greater role in determining a perception, which may create difficulties in reality discrimination (Aleman et al., 2003). However, these findings lack robustness and further empirical support seems to be required to confirm this hypothesis.

Importantly, all the aforementioned studies employed measures assessing volitional mental imagery. Such measures included the “White Christmas” task and the QMI, which assess respectively, volitional auditory imagery vividness and multi-sensory volitional imagery vividness. Volitional imagery has been the dominant interpretation of imagery within this field of investigation, yet is only one construct within the domain of imagery.

In light of this, a final area of investigation has involved the investigation of intrusive imagery. Within clinical populations, it was demonstrated that individuals with a diagnosis of a psychotic disorder, have more intrusive experiences than controls (Morrison & Baker, 2000) and in particular, more intrusive imagery (Morrison et al., 2002a). Furthermore, Holmes and Steel (2004) demonstrated that individuals high in schizotypy experienced more intrusive imagery following presentation of a traumatic film compared to individuals low in schizotypy. However, Jakes and Hemsley (1987) demonstrated that vivid imagery in the general population may be more related to hypnagogic experiences than hallucinations. Within populations with a trauma history, schizotypy was found to be correlated with re-experiencing phenomena such as intrusive imagery (Gracie et al., 2007; Marziller & Steel, 2007).

These findings together are suggestive of a relationship between intrusive imagery and psychotic phenomena. However, the Unusual Experiences scale of schizotypy, and predisposition to hallucination measures may lack sensitivity to differentiate between intrusive imagery and “true” hallucinatory experiences. Furthermore, the methodologies of the studies were limited in terms of their scope to assess causality, relationship direction or mediational factors. The methodologies included, descriptive designs (Morrison et al., 2002a), analogue designs (Holmes & Steel, 2004) and retrospective, cross-sectional designs (Gracie et al., 2007; Marziller & Steel, 2007; Steel, Mahmood & Holmes, 2008).

Furthermore, an alternative explanation of the Holmes and Steel (2004) finding, is that individuals who were high in schizotypy (in particular on the Unusual Experiences scale) may have been more likely to endorse odd items and thus notice,

attend to and report more intrusive phenomena. This has been demonstrated in individuals high in fantasy-proneness, which is highly correlated with schizotypy (e.g. Merckelbach & van der Ven, 2001).

### **Synthesis of the findings**

The first question of the review pertains to whether a relationship exists between hallucinations and mental imagery. The research has demonstrated difficulties in distinguishing between imagery and hallucinations, which creates difficulties in reaching conclusions as to a potential relationship. Nevertheless, the majority of the studies employed measures tapping into volitional imagery and it seems likely that this construct is unrelated to hallucination formation. Indeed, Bentall (1990), in a review of the literature on hallucinations, reached similar conclusions. The few positive findings in the area (e.g. Barrett, 1993; Mintz & Alpert, 1972), may be reflective of a specific response-bias to endorse odd-items. Alternatively, in the general population studies, vivid imagery may be related to hypnagogic experiences rather than hallucinations per se (Jakes & Hemsley, 1987). There have been some suggestions of volitional imagery ability being involved in determining a perception. However, such a relationship lacks robust empirical validation. Consequently, it seems that the research does not strongly support an association between volitional imagery and hallucinations. However, there has been some consistency in the findings between vivid volitional imagery and the psychotic construct (Oertel et al., 2009; Sack et al., 2005; Slade, 1976). It has thus been argued therefore that vivid volitional imagery may represent a trait marker across the schizophrenia spectrum (Oertel et al. 2009).

There have also been some consistent findings in the area of intrusive imagery and psychotic phenomena. Accordingly, intrusive imagery has been demonstrated to be associated with hallucinations or psychotic-like experiences (Morrison et al., 2002a). However, the nature of this association is unclear and these studies have employed either non-experimental or analogue designs. Moreover, determining whether reports of intrusive imagery in these studies are veridical or also representative of a response-bias is unknown.

The modality of imagery and hallucinations is an area rarely addressed by the researchers. Horowitz (1975) proposed that individuals prone to hallucinations might demonstrate an imagery deficit, causing them to misattribute vivid images to an external source. The vast majority of the research has been conducted using participants with auditory hallucinations and has concluded that this is unrelated to volitional imagery in any domain (as assessed via the QMI). In the area of intrusive imagery, the findings are less clear. Morrison and Baker (2000) assessed only auditory hallucinations and the modality of intrusive imagery was not assessed. Similarly, Morrison et al. (2002a) assessed visual imagery but did not comment on the modality of hallucinations. Within the other studies, the modality of intrusive imagery and hallucinations was not the focus of investigation (e.g. Marziller & Steel, 2007).

The second question of the review pertains to whether any theoretical account of a relationship between hallucinations and mental imagery can be supported by the literature. The first theory presented centred on a potential association between the vividness of imagery and hallucinations. It appears that vividness of volitional

imagery is unrelated to hallucinations. In the area of intrusive imagery, no studies were identified that have investigated such a relationship.

Further, the research presented would also not support the theory that hallucinations arise as a result of mis-representing volitional imagery as externally-based perceptions (e.g. Aleman, Bocker & de Haan, 1999). This is based on the work of Kosslyn (1994) that mental images like hallucinations have perceptual qualities and can occur in the absence of sensory stimuli. In determining whether a mental event is externally or internally generated (i.e. a perception or an image) an individual compares the amount of sensory, contextual and semantic attributes of the item (Johnson & Raye, 1981).

However, in many ways this theory might be compatible with theoretical accounts of an association between intrusive imagery and hallucinations. Steel, Fowler and Holmes (2005) argued that hallucinations may arise as a result of weak encoding of contextual information. As such, intrusive memories from traumatic events appear into consciousness involuntarily, contain the sensory and emotion characteristics of the event, but lack the temporal, verbal and contextual information to help make sense of the experience. Therefore, it may be that a hallucination is an intrusive image misrepresented as an external perception as a result of poor contextual information contained within the sensory image. However, despite positive findings of an association between intrusive imagery and hallucinations, direct testing and support for such a theoretical account does not seem to have been demonstrated.

### **Clinical implications and future research**

A number of theoretical accounts propose an association between the vividness of mental imagery and hallucinations. Although this review does not support this relationship in the area of volitional imagery, no studies investigated the vividness of intrusive imagery and hallucinations. Further, the modality of imagery and hallucinations has been a neglected area and so future research could focus on the relationship between the sensory modality of intrusive imagery and hallucinations.

Predominantly, future research may benefit from investigating further the psychological mechanisms underlying intrusive experiences and psychotic phenomena. In particular, to test the predictions of Steel, Fowler and Holmes (2005) that hallucinations may arise as a result of weak encoding of contextual information. This would result in a vulnerability to experience a stream of intrusive material entering consciousness involuntarily. Similarly, the theoretical proposition proposed by Aleman and colleagues (e.g. Aleman, Bocker & de Haan, 1999) that hallucinations may be misrepresentations of mental imagery as external perceptions might bear more fruitful findings if intrusive imagery were tested in addition to volitional imagery.

As intrusive imagery are the sine qua non of PTSD, this area of research poses important questions regarding an association between PTSD and psychosis and indeed trauma and psychosis. Research has already demonstrated a high prevalence of trauma in psychotic populations (Read et al., 2005). Furthermore, similar to the “flashback” in PTSD, Read and Argyle (1999) found an “obvious” link in the content of hallucinations and childhood abuse in over half of their inpatient sample.



From a theoretical standpoint, traumatic events may result in cumulatively weaker contextual processing abilities (Steel, Fowler & Holmes, 2005) resulting in both a vulnerability to experience vivid, emotional and traumatic flashbacks, as well as intrusive imagery from day-to-day stressful events. Such intrusive mental events would be highly affect-laden and difficult to link to autobiographical memories of events. In order to make sense of these experiences of consciousness, Morrison (2001) proposed that some people might make culturally unacceptable interpretations thus creating the template of a hallucinatory experience. Evidently, further research is required in order to guide understanding and treatments.

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## **Part 2: Empirical Paper**

# **The relationship between contextual processing, intrusive imagery and hallucination-proneness**

## **Abstract**

### **Aims**

This study tested the hypothesis that hallucinations exist on a continuum with intrusive imagery and that contextual processing underlies this relationship. The study hypothesised that weak contextual (allocentric) processing would correlate with intrusive images that are vivid, sensory and possess a strong sense of nowness. Further, that hallucination-proneness would also be associated with a weaker contextual system either directly or indirectly via the presence of intrusive imagery.

### **Method**

A cross-sectional, correlation design was employed using a general population sample. 55 participants completed a virtual environment task that probed allocentric and egocentric processing and memory. An intrusive interview paradigm and measures assessing predisposition to psychotic experiences were also employed.

### **Results**

Weaker allocentric processing was associated with intrusive images with a greater sense of “nowness”. Both egocentric and allocentric systems were related to the sensory attributes of intrusive imagery. Predisposition to hallucinations was associated with greater “nowness” of intrusive imagery and post-hoc findings demonstrated a relationship between weaker allocentric processing and more extreme cases on the hallucination scale.

### **Conclusion**

The findings supported some of the hypotheses, which have clinical implications with regard to understanding psychotic features within traumatised individuals and the development of psychosis more widely. Limitations and further areas of research are discussed.

## **Introduction**

Although hallucinations have been demonstrated in physical disorders (Assad & Shapiro, 1986), a range of psychological disorders (e.g. Brewin & Patel, 2010) and in the general population (e.g. Barrett & Etheridge, 1992), they have been predominantly reified into a primary symptom of schizophrenia. More specifically, the symptoms of schizophrenia as defined by the Diagnostic and Statistical Manual of Mental Disorders IV include, hallucinations, delusions and disorganised speech (DSM-IV: APA, 1994). Many researchers have attempted to explain the nature of hallucinatory experiences (e.g. Bentall, 1990), and one such theory centres on the relationship between mental imagery and hallucinations. The majority of the research in this area has employed paradigms probing volitional mental imagery (e.g. Chandirami & Varma, 1987; Mintz & Alpert, 1972) and the findings have been inconsistent and unclear. However, more consistent findings have been demonstrated when investigating a relationship between intrusive imagery and hallucinations.

### **Theories of a relationship between intrusive imagery and psychotic experiences**

A number of theoretical accounts have been proposed to explain an association between intrusive imagery and psychotic experiences. Some authors have argued that people with psychosis and psychosis-prone individuals experience a greater amount of intrusive imagery. For example, within clinical populations, it has been demonstrated that individuals with a diagnosis of a psychosis have more intrusive experiences than controls (Morrison & Baker, 2000) and in particular, more intrusive imagery (Morrison et al., 2002). Holmes and Steel (2004) demonstrated that individuals high in schizotypy experienced more intrusive imagery following presentation of a traumatic film compared to individuals low in schizotypy. Within

populations with a trauma history, hallucinatory type experiences as measured on a schizotypy measure were found to be correlated with greater intrusive re-experiencing phenomena (Gracie et al., 2007; Marziller & Steel, 2007). As a result, both intrusive imagery and hallucinations have been seen as an extension of the same phenomenon. Indeed, Morrison (2001) argued that psychotic experiences and in particular hallucinations, may represent culturally unacceptable interpretations of intrusive mental events. However, the designs of these studies have been limited in terms of their scope to assess causality, relationship direction or mediational factors.

Other theorists have highlighted the phenomenological similarities between intrusive imagery and hallucinations. Intrusive images are often experienced as repetitive, uncontrollable and distressing (Holmes & Matthews, 2005). In posttraumatic stress disorder (PTSD), intrusive re-experiencing images have been found to be directly related to traumatic events (Brewin & Holmes, 2003), carry sensory and emotional information related to the perceived “worst” moment of the trauma (Grey, Holmes & Brewin, 2001), be experienced as occurring in the present (sense of “nowness”: Brewin, Dagleish & Joseph, 1996) and contain a sense of “current threat” (Ehlers & Clark, 2000). Similarly, the content of hallucinations are often directly related to traumatic events (Read & Argyle, 1999), experienced as happening in the present, and appear into consciousness involuntarily (Nayani & David, 1996). Further, these intrusive phenomena are also highly affect laden (Morrison, 2001), and both psychotic hallucinations and PTSD intrusions can contain highly sensory information (Van de Kolk et al., 1996).

A final theory outlines an information processing account to explain a relationship between intrusive imagery and hallucinations. It has been argued that a weakening of the influence of spatial and temporal regularities on perception, may result in a vulnerability to experience intrusions from material stored in long-term memory (Hemsley, 2005; Steel, Hemsley & Pickering, 2002). Following on from this, Steel, Fowler and Holmes (2005) proposed that this ability to integrate information into its spatial and temporal context may exist on a continuum (continuum of contextual integration hypothesis). They argued that individuals with psychosis and psychosis-prone individuals may exhibit a weak “baseline” ability to encode spatial and temporal information. This would result in a vulnerability to experience a stream of intrusive imagery intruding into conscious awareness.

### **An updated theoretical account of a relationship between intrusive imagery and hallucinations**

It is possible to further understand the relationship between hallucinations and intrusive imagery by drawing on recent theories of psychological mechanisms believed to underpin the development of intrusive imagery. One such theory is the revised dual representation theory presented by Brewin and colleagues (2010).

#### *Two Systems*

It has been proposed that there exists two systems for encoding, storing and retrieving memories of events (e.g. Bisby et al., 2010). The revised dual representation theory (Brewin et al., 2010) describes the processes by which intrusive phenomena (in particular images) arise via the specific function and interaction of these two systems.



One system is responsible for encoding as much sensory information as possible relating to an experienced event. Contained within this system are representations bound to the sensations and perceptions, in a form similar to how they were experienced (S-reps). This system is comparable to the one thought to support “flashbulb memories” (Brown & Kulik, 1977). As such, S-reps are encoded as egocentric, viewpoint-dependent, inflexible representations. Recall of S-reps occurs indirectly via the activation of matching environmental (associated) or internal (situational) cues. S-reps are understood to be connected to body state and emotion areas, such as the insula and amygdala (Burgess et al., 2001; Byrne, Becker & Burgess, 2007).

The other system encodes selected features of an event, including visual features, using a set of abstract codes. This system creates representations that are responsible for placing the experience into its appropriate context, including time and space (C-reps). C-reps are encoded and stored as verbally accessible, allocentric, viewpoint-independent, flexible representations, and are understood to be supported by the medial temporal lobe and hippocampus (Burgess et al., 2001; Byrne, Becker & Burgess, 2007).

### *Healthy encoding and recall*

During normal encoding and recall, C-reps and S-reps are believed to be closely linked via representations in the medial parietal cortex (Burgess et al., 2001; Byrne, Becker & Burgess, 2007). Activation of the lower-level sensory cortices during perception of an event activates the higher-level medial temporal structures. Similarly, deliberate retrieval of C-reps from long-term memory triggers the

associated S-reps. Therefore, an S-rep can be activated “bottom-up” via an associated cue, or “top-down” via its connections with higher level representations. During healthy, voluntary recall, S-reps are activated “top-down” and are integrated into their appropriate autobiographical context, which inhibits “bottom-up” re-experiencing.

*Intrusive imagery within the revised dual representation model*

It is well documented that during moments of extreme stress the amygdala is facilitated and hippocampus inhibited (e.g. Metcalfe & Jacobs, 1998). Based on the revised dual representation model this would create strong S-reps and weak C-reps, with impaired connections between them. S-reps would be more likely to be activated “bottom up” via corresponding cues because of the lack of “top down” control. This would result in sensory, vivid, egocentric intrusions that are void of contextual information (including a time-code and spatial information) and vulnerable to automatic retrieval.

Bisby et al. (2010) tested predictions of the revised dual representation theory that weak allocentric encoding and intact egocentric encoding would result in more frequent intrusive images. Participants were divided into a placebo group, a low-dose alcohol group and a high-dose alcohol group. The authors employed a memory task that probes both allocentric and egocentric representations of space (King et al., 2002). Participants also recorded intrusions following a trauma film paradigm. The authors hypothesised that low doses of alcohol would affect the allocentric system, whereas high doses of alcohol would affect both allocentric and egocentric systems. The results demonstrated that the low-dose alcohol group had reduced allocentric

performance and reported more intrusions than the high-dose or placebo groups. This supported the theory of two systems for encoding, retrieving and storing memories of events and that a greater frequency of intrusive imagery is related to weak allocentric encoding with intact egocentric encoding.

### *Intrusive imagery and hallucinations*

It has been argued that a weakening of the influence of spatial and temporal regularities on perception may result in a vulnerability to experience intrusions from material stored in long-term memory (Hemsley, 2005; Steel, Hemsley & Pickering, 2002). Consequently, Steel, Fowler and Holmes (2005) proposed that this ability to integrate information into its spatial and temporal context may exist on a continuum with those at the weaker end vulnerable to experiencing more intrusive, hallucinatory-type experiences.

Within the revised dual representation model this would mean that a relatively weaker “baseline” ability to form allocentric C-rep with intact S-reps would result in a vulnerability to experience a flood of highly sensory, vivid intrusions, void of contextual information. These intrusions would also be void of a verbal narrative and difficult to link to a memory of an event. Accordingly, a hallucination is argued to be on the extreme end of an intrusive imagery continuum, and thus is an individual’s best attempt to make sense of this experience of consciousness (Morrison, 2001).

### **Gaps in the literature**

Despite these theories there is little in the way of empirical support. It is important to test predictions of the revised dual representation theory (Brewin et al., 2010) in

terms of the mechanisms by which intrusive images may develop. As such, no research has been identified that has assessed the relationship between the properties of intrusive imagery and egocentric versus allocentric processing. To date, no research has also tested to what extent egocentric and allocentric processing is related to hallucinatory experiences.

### **Current Study**

The revised dual representation theory (Brewin et al., 2010) provides theoretical support for speculating that a specific information processing style may incur vulnerability to intrusive imagery. Further, it has been argued that this information processing style may exist on a continuum, with those at the weaker end exhibiting more intrusive, hallucinatory type experiences (Steel, Fowler & Holmes, 2005).

This study aims to test the revised dual representation theory (Brewin et al., 2010) and updated version of the contextual integration hypothesis. More specifically, it is the first study to investigate the relationship between the properties of intrusive imagery and egocentric versus allocentric processing. Further, this is the first study to investigate a relationship between hallucinations and egocentric versus allocentric processing. It is hoped that results from this study will contribute to an understanding of the relationship between intrusive imagery and hallucinations and psychological mechanisms that may underlie this relationship.

### *Hypotheses*

1. It is predicted that participants who report intrusive images versus participants who do not report intrusive images, will have weaker allocentric

processing with intact egocentric processing abilities. Further, for participants who do report intrusive imagery, greater frequency of images will be related to weaker allocentric and intact egocentric processing.

2. Greater predisposition to hallucinations is predicted to be related to greater frequency of intrusive imagery.
3. Weaker allocentric and intact egocentric abilities is hypothesised to correlate with intrusive images that have a greater sense of “nowness” (the extent to which the intrusive image is experienced as a real event occurring in the present), and greater sensory properties, and are more uncontrollable, vivid and emotional.
4. It is also hypothesised that weaker allocentric and intact egocentric processing will correlate with hallucination-proneness, either directly or indirectly via the sense of “nowness”, vividness and/or sensory detail of intrusive imagery.

## **Method**

### **Participants**

55 participants were recruited from the research subject pool of the Department of Clinical, Health and Education Psychology at University College London (UCL). Participants were aged between 18-52 years and were paid £10 for participation.

### **Ethics**

The study was granted UCL ethics approval (see appendix 1) and conducted in accordance with these policies and procedures. Participants were provided with

information about the study in an information sheet prior to participation (see appendix 2). In addition, participants signed a consent form (see appendix 3), which detailed confidentiality and privacy procedures, and stated that participants could withdraw from the study at any point. All data was anonymised to ensure confidentiality, and electronic data was kept on a secure UCL account at all times.

### **Study Design**

A one-group, cross-sectional, analogue design was employed.

### **Power analysis**

Based on a Multiple Regression, medium effect size (0.15), Alpha at 0.05, Power at 0.8 and 2 predictors, Sample Size (N) = 55. This was calculated using G\*Power (Faul et al. 2007). A medium rather than small effect size was selected in order to manage the practicalities of carrying out this research.

### **Procedure**

Participants were invited to take part in a study investigating, “mental imagery and unusual experiences”. Participants were provided with a participant information sheet and allocated an allotted time slot if they still wished to take part. Participants were told to set aside 1 hour and 15 minutes to complete the testing. All participants completed the following in the following order: An information-processing task assessing allocentric and egocentric encoding (King et al., 2002); the State-Trait Anxiety Inventory (STAI: Spielberger, 1983); questionnaires assessing predisposition to psychotic phenomena, including, the Revised Launay-Slade Hallucination Scale (LSHS-R: Bentall & Slade, 1985; Launay & Slade, 1981), the

shortened version of the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE(s): Mason, Linney & Claridge, 2005). Participants finally completed an intrusive imagery interview (based on Patel et al., 2007)

*Virtual environment (VE) task - King et al. (2002)*

King et al. (2002) designed a task that investigates egocentric and allocentric encoding and retrieval. The task was originally used to test a patient with focal bilateral hippocampal damage and demonstrated selective allocentric impairment. The task has subsequently been demonstrated as a valid and reliable tool for assessing contextual processing (e.g. Bisby et al., 2010).

On a computer screen participants were presented with a virtual environment (VE) consisting of a courtyard surrounded by visually distinct buildings. Twenty-one place-holders were randomly distributed throughout the courtyard. Participants were initially given a familiarisation task, whereby they are able to move around the available viewing areas. At presentation, a list length of either, 3, 6 or 9 everyday objects appeared one-by-one over one of the placeholders. Following presentation, each image was presented with 3 foils positioned over adjacent placeholders from either the same-viewpoint as the presentation stage (egocentric condition) or a switched-view (140 degrees, allocentric condition). Participants were required to identify the object from the presentation stage (see appendix 4 for images of the VE task). The task consisted of 36 trials in total: 6 trials of the 3, 6, 9 list lengths tested from the same-viewpoint; and 6 trials of the 3, 6, 9 list lengths tested from the switched-viewpoint.

### *Intrusive imagery interview*

An intrusive imagery interview is a common method for investigating intrusive experiences (Brewin et al., 2010). Patel et al. (2007) employed the paradigm in a study investigating intrusive images and memories in major depression.

Following a brief description of intrusive imagery, participants were asked to report 2 intrusive images that had automatically and spontaneously appeared in their minds during the past week or during a typical week. The frequency of the images and whether they related to an autobiographical memory were recorded. Participants were asked to rate on a scale from 0 (not at all) to 100 (very much so), the extent to which various emotions (shame, anger, anxiety, sadness, guilt, happiness) and sensory details (taste, sound, olfactory, tactile, visual) accompanied the images. The vividness, interference with daily activities, uncontrollability, distress and sense of “nowness” were also rated on the same scale. “Nowness” was explained as the extent to which the image felt like a real event actually happening in the present. See appendix 5 for the intrusive imagery interview schedule.

### *The shortened version of the Oxford-Liverpool Inventory of Feelings and Experiences (O-Life(s); Mason, Linney & Claridge, 2005)*

The short form of the O-LIFE questionnaire was used to assess psychosis-proneness. This measure yields four factors: Unusual Experiences (O-LIFE\_UE: An analogue of positive symptoms of schizophrenia, including hallucinations); Cognitive Disorganisation (O-LIFE\_CD: Corresponds to thought disorder); Introverted Anhedonia (O-LIFE\_IA: Negative symptoms of schizophrenia); and Impulsive Non-conformity (O-LIFE\_IN: Relates to behavioural impulsivity). The O-LIFE(s) has



been found to have good reliability, content validity and concurrent validity (Mason, Linney & Claridge, 2005). In order to maintain reliability, the whole questionnaire was used. However, only the Unusual Experiences subscale is subsequently reported.

*The Revised Launay-Slade Hallucination scale (LSHS-R) (Bentall & Slade, 1985; Launay & Slade, 1981)*

The LSHS-R is a frequently used measure of predisposition to hallucinations in the general population. 12 items are scored on a five-point scale and describe either clinical or subclinical hallucinatory experiences. The LSHS-R has been demonstrated to have good reliability and validity (Aleman et al., 1999a).

*Spielberger's State-Trait Anxiety Inventory (STAI; Spielberger, 1983)*

The STAI is a frequently used self-report measure designed to assess state and trait anxiety. The STAI state scale consists of 20 statements regarding current feelings of anxiety, rated on a 4 point scale ranging from not at all to very much so. The STAI trait scale consists of 20 statements regarding general anxiety and is rated on a 4-point scale ranging from almost never to almost always. The STAI has been found to have good psychometric properties (Oei, Evans, & Crook, 1990).

## **Results**

All 55 participants completed the study. Of these participants, 23 were male and 32 were female. 31 participants identified themselves as students and 24 were non-students. The age range of the participants was 18-52 years with a mean of 24 years, a median of 23 years, and a mode of 21 years. No gender, age or student status effects were demonstrated.

## **Preparing the data**

### *VE Task*

On the VE task, the same-view and switched-view conditions consisted of 3 list lengths (3, 6 & 9) and a total score was created for each. Preliminary analysis demonstrated high consistency between the scores on each separate list length. For parsimony, only the total scores have been included in the analysis and both met assumptions of normality.

### *Hallucination-proneness measures*

The data was tested to determine whether normality assumptions were met. Both the LSHS-R and the O-LIFE\_UE met normality assumptions. 2 participants did not complete the O-LIFE\_UE due to an error in distributing the questionnaires.

### *Intrusive imagery interview*

36 participants reported at least 1 intrusive image and of these, 24 reported 2 intrusive images. Consequently, when two images were reported, the highest score on each variable was used. This allowed for the maximum amount of data to be used from all 36 participants who completed the interview. A total sensory score was formed by adding together the sensory scores (taste, sound, olfactory and visual). Due to floor effects on the frequency data, groups were created of participants with no imagery reports (N=19), participants with a frequency of images up to once a week (N=17) and more than once a week (N=19). The memory data was recorded as follows; neither the first or second image was reported as a memory (N=19), either the first or second image was a memory (N=14). Preliminary analysis demonstrated no effect on any of the tasks if the image was or was not reported as a memory.

Due to floor effects, on the intrusive image scores, the following did not meet assumptions of normality; frequency, sadness, happiness, guilt, shame, anger, anxiety, vividness,nowness, impact, distress. Transformations were attempted. However, these were insufficient to produce variables meeting normality assumptions. Consequently, non-parametric tests were employed.

### *STAI*

The mean State anxiety score was 34 (SD=8.39) and the mean trait score was 41.28 (SD=9.65). Preliminary analysis demonstrated no informative effects of state or trait anxiety on any of the tasks.

### **Relationship between the VE task and frequency of intrusive imagery**

On a Spearman's Rho correlation, no significant association was demonstrated between frequency of intrusive imagery and scores on the same-view condition ( $r(36)=-.123$ ,  $p=.481$ ) or switched-view condition ( $r(36)=-.214$ ,  $p=.217$ ).

A one-way ANOVA was employed comparing the total switched-view scores between participants with no imagery (N=19), participants with a frequency of images up to once a week (N=17) and more than once a week (N=19). No significant main effect was demonstrated ( $F(2,55)=2.02$ ,  $p=.142$ ). On a post-hoc Tukey test, no differences were demonstrated between any of the groups (greatest significance was  $p=.119$ ). There was also no main effect between the frequency groups on the same-view condition ( $F(2,55)=0.976$ ,  $p=.383$ ), and no effects were demonstrated between any of the groups on a post-hoc Tukey test (greatest significance was  $p=.4$ ). See table 1 for a summary of the means.

## Relationship between hallucination-proneness and frequency of intrusive imagery

A one-way ANOVA compared the frequency groups and scores on the LSHS-R. The model demonstrated a significant main effect ( $F(2,55)=5.683$ ,  $p=.006$ ). Follow-up tests were conducted to evaluate differences between the groups. An almost significant difference was demonstrated between the no imagery group and the less than once a week group ( $p=.054$ ). The difference between the no imagery group and the more than once a week group was significant ( $p=.006$ ). No difference was demonstrated between the less than once a week group and more than once a week group ( $p=.714$ ). The means are reported in table 1.

A one-way ANOVA comparing frequency of images with the OLIFE\_UE did not produce a significant main effect ( $F(2,53)=2.798$ ,  $p=.07$ ). However, on a post-hoc Tukey test there was almost a significant difference between the no imagery group and the more than once a week group ( $p=.054$ ). Further, there was a trend for greater frequency of intrusive imagery to indicate greater mean scores on the OLIFE-UE (see table 1).

**Table 1** *Frequency of intrusive imagery & scores on LSHS-R, O-LIFE\_UE, total same-view & total switched-view*

Intrusive image frequency	Mean total Switched-view	Mean total Same-view	Mean LSHS-R	Mean O-LIFE_UE
No Image	1.86 (0.64) N=19	2.23 (0.45) N=19	9.29 (5.56) N=19	3.32 (2.14) N=19
Up to once a week	2.07 (0.45) N=17	2.38 (0.25) N=17	14.7 (6.96) N=17	4.00 (2.55) N=16
More than once a week	1.67 (0.65) N=19	2.21 (0.38) N=19	16.47 (7.78) N=19	4.74 (2.13) N=18

### **Associations between the VE task and the intrusive imagery interview**

The next aspect of the analysis was to compare scores on the VE task and responses on the intrusive imagery interview. Employing a Spearman's Rho correlation, the total switched-view condition was significantly correlated in a negative direction with intrusive image nowness. The total same-view score was also negatively correlated with intrusive image nowness happiness and vividness. Using a Pearson's correlation the total sensory score was negatively correlated with total switched-view and total same-view. See table 2 for a summary of the correlation statistics.

In order to determine the independent effect of allocentric processing, a partial correlation was performed. When controlling for total same-view, total switched-view was correlated with intrusive image nowness ( $r(36)=-.545$ ,  $p=.001$ ). However, no correlation was demonstrated between total switched-view and the total sensory score ( $r(36)=-.103$ ,  $p=.558$ ). When controlling for total switched-view there were no correlations between the total same-view condition and intrusive image nowness ( $r(36)=.147$ ,  $p=.398$ ) or total sensory ( $r(36)=-.166$ ,  $p=.342$ ).

Spearman's Rho correlations were employed between the VE task and items of the intrusive imagery interview measuring emotional valence, impact on daily functioning, uncontrollability, and distress. The only significant correlation was between the total same-view and happiness. All the correlation statistics can be found in table 2.

**Table 2** *Correlation between VE task and intrusive imagery interview*

	Total switch view (N=36)	Total same view (N=36)
Sad	.267	.297
Happy	-.268	-.342*
Guilt	-.145	-.012
Shame	-.092	.063
Anger	.105	.136
Anxiety	-.021	.205
Helpless	.184	.259
Vividness	-.321	-.351*
Nowness	-.666**	-.423*
Impact	-.289	-.094
Uncont.	.041	-.058
Distress	.124	.213
Sensory	-.354*	-.374*

\*\*=significance < .01; \*=significance < .05

### **Associations between the VE task and hallucination-proneness**

There were no significant correlations between the VE task and LSHS-R (greatest significance;  $P=.619$ ) or the O-LIFE\_UE (greatest significance;  $P=.114$ ). However, there is evidence for an estimated base rate of between 10% and 30% for a schizotypy taxon within the general population (Horan et al., 2004; Linscott & van Os, 2010). This is suggestive of a potential non-linear correlation between schizotypy and the VE task. Consequently, two groups were created in order to determine if participants who scored high on the OLIFE\_UE would differ on VE task performance. The high group was cut at a point whereby a double figure N could be

reached, providing this was within the 10%-30% range. Thus, a high group consisted of scores of 6 and above (N=13), which represented 26% of the population. A low group consisted of participants with scores of 5 and below (N= 40). Employing an independent samples *t* test a significant difference was demonstrated between the groups;  $t(51)=2.252$ ,  $p=.029$ . The mean switched-view score for the low O-LIFE\_UE group was 1.99 (SD=0.57), whilst the mean score for the high O-LIFE\_UE group was 1.57 (SD=0.59). An ANCOVA was employed, in order to determine whether the difference remained after controlling for the same-view condition. No main effect was demonstrated ( $F(2,53)=2.011$ ,  $P=.162$ ). No difference was also demonstrated between the high and low O-LIFE\_UE groups on the same-view condition ( $t(51)=1.724$ ,  $P=.91$ ).

**Table 3** *Correlations between VE task and hallucination-proneness*

	Total switch view	Total same view
LSHS-R	.017 (N=55)	-.068 (N=55)
O-LIFE_UE	-.242 (N=53)	-.249 (N=53)

\*\*=significance < .01; \*=significance < .05

### **Associations between hallucination-proneness and intrusive imagery interview**

On a Spearman's Rho correlation, the LSHS-R was negatively correlated with intrusive image sadness, anxiety and helplessness. There was a significant association between the OLIFE\_UE and intrusive image nowness. However, when comparing the nowness scores with the two O-LIFE\_UE groups described above, no significant difference was demonstrated ( $t(32)=-.813$ ,  $p=.416$ ). The LSHS-R was also not correlated with nowness. See table 4 for a full summary of the correlation statistics.

**Table 4** *Correlations between hallucination proneness and intrusive imagery interview*

	O-LIFE_UE (N=34)	LSHS-R (N=36)
Sad	-.202	-.342*
Happy	-.105	-.152
Guilt	.202	.193
Shame	.213	.123
Anger	.117	-.139
Anxiety	.085	-.349*
Helpless	-.169	-.355*
Vividness	.049	.018
Nowness	.386*	.006
Impact	.114	.035
Uncont.	-.056	-.026
Distress	.067	-.213
Sensory	.062	-.017

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\*\*=significance < .01; \*=significance < .05

#### **Associations between intrusive imagery variables**

Employing a Spearman's Rho correlation intrusive imagery nowness was correlated with vividness, and total sensory detail. The nowness scores were not correlated with the emotional valence items, impact on daily events and uncontrollability. Distress was found to be correlated with a number of items including; sadness, guilt, shame, anger, anxiety and helplessness. Sensory detail was also positively correlated with vividness. A correlation matrix of all the variables on the intrusive imagery interview can be found in table 5.



**Table 5** *Correlations between variables on the intrusive imagery interview (N=36)*

	Sad	Happy	Guilt	Shame	Anger	Anxiety	Helpless	Vividness	Nowness	Impact	Uncont.	Distress	Sensory
Sad													
Happy	-.273												
Guilt	.291	-.101											
Shame	.437**	-.199	.695**										
Anger	.550**	-.57**	.211	.287									
Anxiety	.416*	-.378*	.135	.299	.51**								
Helpless	.57**	-.47**	.107	.237	.028	.634**							
Vividness	-.117	.097	.111	.04	.079	-.183	-.078						
Nowness	-.232	-.014	.280	.249	.012	.275	.002	.336*					
Impact	.215	-.063	.254	.345*	.195	.265	.144	.156	.216				
Uncont.	.211	-.244	.180	.157	.596**	.186	.177	.397*	.315	.266			
Distress	.613**	-.385*	.368*	.534**	-.124	.54**	.534**	-.173	.151	.019	.251		
Sensory	-.037	.1	.249	.288		.104	-.21	.389*	.485**	.213	.312	.022	

\*\*=significance < .01; \*=significance < .05

## **Discussion**

This study sought to test predictions of the revised dual representation theory (Brewin et al., 2010) and an updated account of the continuum of contextual integration hypothesis. Accordingly, hallucinations are argued to be on an extreme end of a continuum with intrusive imagery. Further, in accordance with theoretical assumptions, weaker allocentric processing with intact egocentric processing is argued to underlie this relationship. The findings demonstrated some support for this proposed relationship but further research is recommended due to a lack of robustness with some of the findings.

Contrary to the revised dual representation theory and previous findings (e.g. Bisby et al., 2010), no relationship was demonstrated between the frequency of intrusive imagery and egocentric and allocentric processing. However, a significant relationship was demonstrated between greater frequency of intrusive imagery and greater hallucination-proneness. This finding is congruent with an updated continuum of contextual integration hypothesis, and with previous research that has demonstrated a relationship between predisposition to the positive symptoms of psychosis and greater frequency of intrusive imagery (e.g. Holmes & Steel, 2004). However, there are two methodological issues with regard to the frequency data, which may explain the disparity in the findings. Firstly, participants appeared to find it difficult to provide an accurate response to the frequency of intrusive imagery question and so provided an estimate as a response (e.g. many participants approximated once a week). This produced the floor effects on this variable, which may reflect both a lack of variability in the frequency data as well as potentially a

lack of reliability. Secondly, the group of participants who did not report intrusive imagery were assumed to not experience intrusive imagery. However, it may be, for example, that a number of participants in this group did not want to report intrusive imagery with emotional content, in the absence of an appropriate therapeutic relationship.

There was a clear and strong relationship between weaker allocentric processing (independent of egocentric processing) with the sense of “nowness” of intrusive imagery. This finding lends support to the revised dual representation theory (Brewin et al., 2010), in particular with regard to the presence of two independent yet connected systems (egocentric and allocentric) that are responsible for encoding, storing and retrieving memories of events. Further, in accordance with an updated continuum of contextual integration hypothesis, it was demonstrated that intrusive imagery with a greater sense of “nowness” was related to greater hallucination-proneness.

Accordingly, in explaining the findings presented above, it may be that a weaker allocentric system produces C-reps, which are less able to command “top-down” control with the corresponding S-rep. This results in S-reps which lack contextual (including temporal and spatial) information and which are more vulnerable to automatic retrieval. Further along a weaker allocentric continuum, the more the intrusive image is experienced as happening in the present, the more likely it is that this experience of consciousness will be interpreted as hallucinatory. However, it should be noted that the relationship between hallucination-proneness and the sense

of “nowness” of intrusive imagery was only demonstrated on one of the two hallucination-proneness scales.

Additionally, a significant number of the intrusive images were not reported as being related to a memory of an event. This implies that the allocentric and egocentric systems may be involved in the development of unconscious, imagined, yet intrusive autobiographical scenes, as well as the processing of real events. This may have further implications for understanding hallucinatory experiences, which are essentially intrusive, perceptual events experienced in the absence of appropriate stimuli (Slade & Bentall, 1988).

Accordingly, the results demonstrated that both egocentric and allocentric processing systems might be involved in the development of the sensory detail of intrusive imagery. This finding is interesting considering the high level of hallucinatory-type experiences, and in particular voice-hearing experiences, that are often reported by individuals with a trauma history (e.g. Brewin & Patel, 2010). The results did not identify independent effects of allocentric and egocentric processing with the sensory detail of intrusive imagery. However, this is not necessarily unexpected. The revised dual representation theory (Brewin et al., 2010) would predict that the sensory detail of intrusive images are coded by the egocentric system, whilst the allocentric system is responsible for providing context to this experience and controlling automatic retrieval. Regarding the VE paradigm, it is possible that with the same-view condition, participants could employ either allocentric or egocentric memory to solve the task, whereas with the switched-view, only the allocentric memory could be used.

Consequently, a purer test of egocentric processing might allow for more precise testing of the relationship between the sensory detail of intrusive imagery and egocentric and allocentric processing.

Despite the findings presented above, the data did not demonstrate any correlations between allocentric and egocentric processing with hallucination-proneness.

However, as there is some evidence suggesting an estimated base rate of between 10% and 30% for a schizotypy taxon within the general population (e.g. Horan et al., 2004; Linscott & van Os, 2010), a high and low hallucination-proneness group was formed. Accordingly, it was demonstrated that the high hallucination-proneness group performed significantly worse on the allocentric condition than the low hallucination-proneness group. However, this difference did not remain when controlling for egocentric processing. Further, as this was not an a priori condition and the size of the groups were very different, only tentative conclusions can be made. Nevertheless, the findings suggest that weak allocentric processing may be involved in the development of hallucinations, but only in the more extreme cases. Further, according to the results of this study, this effect was not independent of egocentric processing. Theoretically, this might be expected, as hallucinations are experienced as sensory perceptions, and S-reps are believed to code sensory details.

An unusual finding was the absence of a relationship between the emotional valence, vividness or uncontrollability items of the intrusive imagery interview and scores on the information-processing task. It is possible that the floor effects on the emotional valence items may have contributed to the absence of a finding. Regarding the

vividness and uncontrollability data, an alternative scale (e.g. a likert scale) might have helped participants report more variable data for these variables. The final group of findings relates to the relationships between the variables on the intrusive imagery interview. The variables measuring the sense of “nowness”, sensory detail and vividness were all positively correlated with each other. Distress was also correlated with most of the emotional valence items. Consequently, distress appears to be an important variable to include within this paradigm.

### **A pathway to hallucinatory experiences**

The findings of this study lend some support to the revised dual representation theory (Brewin et al., 2010) and an updated continuum of contextual integration hypothesis. Accordingly, a weaker “baseline” allocentric system results in C-reps less able to command “top down” control, which leaves S-reps vulnerable to automatic retrieval. The resulting intrusive images have a greater sense of “nowness” because the C-rep is providing fewer details of context, such as time and space. According to the results of this study and in line with an updated continuum of contextual integration hypothesis, these intrusive images that have strong sensory elements and are experienced as real events may explain hallucinatory experiences demonstrated in individuals with a PTSD diagnosis and in the more extreme cases, hallucinations more congruent with a psychosis diagnosis. Indeed, lending inductive support to this hypothesis, only two participants identified themselves as having heard voices on the hallucination-proneness scale. Both of these participants reported very weak scores on the allocentric task and very high scores on the variables of the intrusive imagery interview.

However, these conclusions need to be evaluated in the context of a lack of robustness with some of the findings. Firstly, there were inconsistencies between the two hallucination-proneness measures with regard to the frequency of intrusive imagery, and sense of “nowness” of intrusive imagery. Secondly, although results demonstrated that the group with more extreme hallucination-proneness had reduced allocentric encoding, this was not an a priori condition, and so may represent a false positive. Thirdly, no hypothesised relationships were demonstrated between the frequency and emotional valence items of intrusive imagery with egocentric and allocentric processing. However, this may have been due to the floor effects demonstrated on these items.

### **Clinical implications**

This study lends further support to the revised dual representation theory (Brewin et al., 2010), which outlines two systems responsible for the encoding of traumatic autobiographic events and the development of intrusive imagery. The study also provided some support to an updated continuum of contextual integration hypothesis. Accordingly, the study has implications for understanding the development of posttraumatic stress disorder (PTSD), whereby intrusive re-experiencing symptoms are the sine qua non of the condition. Furthermore, the findings have implications for understanding hallucinations demonstrated in individuals diagnosed with a psychotic disorder and in other psychological and physical disorders.

It is widely reported that hearing voices and other psychotic experiences are common in individuals with a trauma history, and dissociative mechanisms have been argued

to underlie this process (Brewin & Patel, 2010; Kilcommons et al., 2008). Akin to dissociative theories, the revised dual representation theory outlines the peritraumatic processing and associated neurobiological mechanisms that occur in response to heightened stress. The results of this study suggest that individuals with relatively weaker “baseline” allocentric abilities may be more vulnerable to this process, resulting in intrusions with greater sensory attributes.

Consequently, this has implications for therapeutic work with individuals diagnosed with PTSD. Firstly, normalising sensory, hallucinatory-type experiences as an understandable posttraumatic response might be a helpful, therapeutic aspect of an intervention. Secondly, therapies which seek to integrate the trauma memory with its appropriate contextual counterpart may help to alleviate the experience of “current threat” (Ehlers & Clark, 2000), as well as the sensory, hallucinatory-type experiences, which are invariably linked.

There are also evident implications for individuals diagnosed with a psychotic disorder. It may be that for many individuals diagnosed with a psychotic disorder, hallucinations represent extreme traumatic flashbacks, which contain highly sensory-laden information. In accordance with this, Read and Argyle (1999) demonstrated that the content of hallucinations in individuals with a diagnosis of schizophrenia, matched concrete details of childhood, physical and sexual abuse. Further, Beck and Van de Kolk (1987) identified that sexual delusions were common in incest survivors. Consequently, given the prevalence of trauma in psychotic populations (Read et al., 2005), assessment of psychotic experiences should invariably involve a



full history with a focus on traumatic experiences. However, it should be noted that in accordance with the theory (e.g. Brewin et al., 2010), the details of traumatic events might be difficult to recall verbally, especially in the absence of appropriate therapeutic conditions.

The current study also demonstrated how intrusive images that are not memories of autobiographic, traumatic events can also contain the sense of “nowness” and sensory attributes, in individuals with appropriate information processing styles. Consequently, traumatic events may be an important, but not an altogether necessary condition for the development of hallucinations. In these instances, it is possible that a weak allocentric system and intact egocentric system may create the conditions for intrusive hallucinatory-type experiences.

In line with this, Mayhew and Gilbert (2008) demonstrated very positive results employing compassionate mind training (CMT) with a group of chronic malevolent voice-hearers. CMT is aimed at self-soothing and inhibiting the stress-response system. Accordingly, this approach may serve to inhibit activation of S-reps contained within the egocentric system. Alongside such an approach, therapies that seek to strengthen the allocentric system, which would create C-reps capable of commanding “top-down” control on S-reps, may also be beneficial. For example, Morrison (2004) employed an imagery reliving and re-scripting therapy with a man with psychosis and demonstrated positive results.

Furthermore, hallucinations have been demonstrated in a range of physical disorders (Assad & Shapiro, 1986). Consequently, the approaches detailed above may be beneficial in helping individuals distressed by hallucinations more widely.

### **Future research**

It is important to replicate the study with the addition of a purer test of egocentric processing. This would allow for more precise testing of the revised dual representation theory (Brewin et al., 2010) and its relation to intrusive imagery and psychotic experiences. In addition, it would perhaps be more reliable to use a likert scale on a number of the variables of the intrusive imagery paradigm including, frequency and emotional valence.

There was some suggestion of more extreme cases on the Unusual Experiences scale of the O-LIFE demonstrating significantly poorer allocentric processing.

Furthermore, two participants who reported hearing voices on the LSHS-R demonstrated the lowest score on the allocentric condition of the VE task and had exceptionally high scores on the intrusive imagery interview. Therefore, it would be important to replicate the study employing a screening measure to include a group of voice-hearers in the general population. The paradigm could also be replicated in both a traumatised and/or psychotic clinical populations.

### **Limitations**

#### *Design*

The study employed a one-group, cross-sectional design. This means that associations can be identified but causality cannot be determined. The study also employed an analogue design, sampling from a research pool of students and adult participants. Despite evidence for a continuum approach to psychotic experiences (Claridge, 1987), this does limit the external and ecological validity of the findings, in particular to clinical populations in naturalistic environments.

### *Statistical considerations*

Through analysing the data a number of correlations were used with no corrections made for chance significance, thus increasing Type 1 error probability. However, with this in mind it was vital to have clear hypotheses from the outset and the findings represent a pathway towards further research rather than an endpoint.

### *Intrusive Interview schedule*

There were a number of different ways the intrusive imagery data could be analysed. Due to the high consistency between the first image and the highest scores and for reasons of parsimony, it was decided that only the highest imagery scores would be reported. It is recognised that this means that scores do not represent participants' reports of their experiences of an individual intrusive image, however, it may represent an individual's "intrusive imagery potential". Nevertheless, this method of analysing the intrusive imagery data does represent a potential validity issue.

The interview schedule was based on Patel et al. (2007), who demonstrated it as a reliable way of assessing intrusive experiences. However, in neither the current

study, nor Patel et al. (2007), was the interview schedule formally assessed for properties of reliability and validity. Moreover, concerns have been highlighted with regard to the reliability of introspective reports (Aleman et al., 1999a). For example, it has been demonstrated that some individuals may demonstrate a tendency to endorse odd items within an experimental paradigm (e.g. Merckelbach & van de Ven, 2001). As such, it is unknown to what extent reports on the interview represent adherence to perceived demand characteristics of the experiment. However, asking individuals to report the content of their imagery may have counteracted this process. Alternative methods to assess intrusive imagery could include screening for participants with intrusive imagery or using the trauma film paradigm, which has been used in previous studies (e.g. Bisby et al., 2010).

#### *VE Task*

The task took approximately 45 minutes to 1 hour to complete and required steady concentration throughout this time. Factors that may have affected performance include motivation, attention and fatigue. In particular, the switched-view condition requires additional attention and this may have been a factor in addition to contextual processing abilities affecting performance. However, the task has been used in a number of studies and consistently been demonstrated as a valid and reliable tool for assessing contextual processing (e.g. Bisby et al., 2010). Moreover, from an observational perspective, participants appeared on the whole engaged and motivated to do well on the task.

#### *Hallucination-proneness measures*

The hallucination-proneness measures used in this study were the LSHS-R and the O-LIFE(s). They are based on the assumption that hallucinatory and other psychotic experiences exist on a continuum within the general population (Claridge, 1987). Regarding hallucinatory experiences, one factor demonstrated to exist within the measures is vivid imagery/daydreams (Waters, Badcock & Maybery, 2003). However, empirical evidence has not reached a consensus that vivid volitional imagery is in any way related to hallucinatory experiences (Bentall, 1990). Therefore, the measures may lack some construct validity with regard to assessing a “true” continuum of hallucinatory experiences. Similarly, another factor demonstrated to exist within the measures is intrusive imagery (Waters, Badcock & Maybery, 2003). Consequently, the measures may also lack sensitivity to differentiate between intrusive imagery and hallucinations.

### *Conclusions and summary*

This study aimed to test the revised dual representation theory (Brewin et al., 2010) and an updated version of the contextual integration hypothesis. More specifically, it was the first study to investigate the relationship between the properties of intrusive imagery and egocentric versus allocentric processing. Further, this was the first study identified to investigate a relationship between hallucinations and egocentric versus allocentric processing.

In support of the revised dual representation theory (Brewin et al., 2010), it was demonstrated that weaker allocentric processing independent of egocentric processing was associated with a greater sense of “nowness” of intrusive imagery.

The sensory component of the images was related to both information processing systems but further research is required to confirm the nature of this relationship. However, the findings relating to the frequency of intrusive images did not support the revised dual representation theory.

In line with an updated continuum of contextual integration hypothesis, greater hallucination-proneness was related to greater frequency of intrusive imagery, and intrusive imagery with a greater sense of “nowness”. There was also some evidence suggesting that more extreme hallucination-proneness was associated with weaker allocentric processing abilities. However, further support is required to confirm this hypothesis.

Further research employing more extreme cases of hallucinatory-type experiences in the general population or in clinical populations is recommended to identify further support for a relationship between hallucinations and intrusive imagery, and the information processing styles that may underlie this relationship.

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## **Part 3: Critical Appraisal**

## **Introduction**

This critical appraisal of the research process is focussed on 3 broad areas. Firstly, in order to provide some context to the research, I present some of the key reasons underlying the selection of topic. Secondly, I discuss two theoretical assumptions underpinning the research: The continuum approach to psychosis; and traumatic experiences as a contributing factor to psychosis. Thirdly, I discuss practical and conceptual issues related to measuring hallucinations and intrusive imagery. I end with a summary and final reflections on the research process.

### **Selection of topic**

In 2003, I undertook my undergraduate research on attribution biases in paranoia at the University of Manchester. Consequently, my views on psychosis were, at the time, very much situated in the idea that psychotic experiences are part of a continuum of “normal” psychological processes. This work greatly influenced my interest in undertaking critical, yet empirical research in general, and in particular on the broad area of psychosis.

Upon selecting a topic for my doctoral research, I was keen to further build on my knowledge and experience of psychosis research, in order to further contribute to a psychological understanding of psychotic experiences. It was through both psychosis training and my experiences on clinical placements that influenced my selection of topic.



Whilst on placement in a community mental health team (CMHT), I attended a ward round at the local psychiatric inpatient unit. One of the patients seen at the ward round was a young male who had experienced a paranoid breakdown after starting at university. Upon reading his file, I was struck by his history of living in multiple care homes and pervasive experiences of childhood sexual abuse. Perhaps naively at the time, I was astonished that the team did not deem this information relevant, and it was clear from the discussion that his psychotic experiences were understood as part of a biologically based, genetic brain disorder. Another patient discussed in the ward round was a woman with delusions of being poisoned and she thus was refusing anti-psychotic medication. Without irony, it was agreed that the medication should be covertly hidden in her food.

As a first-year trainee clinical psychologist in the first few weeks of training, I can recall the paralysing sense of powerlessness I felt in being unable to shift a discourse dominated by a medical and paternal view of distress and psychotic experiences. From a psychodynamic perspective it could also be argued that I was identifying with the powerlessness experienced by the patients (Lemma, 2003).

Almost simultaneously, at university we had a series of teaching sessions on psychosis. One in particular focussed on the impact of trauma on psychotic symptoms and introduced the work of various researchers including, Anthony Morrison, John Read, and Craig Steel. The idea that large proportions of those diagnosed with a psychotic illness have experienced childhood traumatic

experiences, very much resonated with my experience on placement and my assumptions about psychosis.

Through further reading and discussion, I became interested in the idea of a convergence between posttraumatic stress disorder (PTSD) and psychosis, and in particular, the idea that psychosis might even be best understood as a complex trauma reaction (Read et al., 2005). Despite much evidence of the high prevalence of trauma in psychotic populations (e.g. Janssen et al., 2004) and conversely, the high prevalence of psychotic experiences in traumatised individuals (Brewin & Patel, 2010), a clear understanding of this relationship seemed to be in its infancy. As such, researching the psychological mechanisms that might mediate a relationship between trauma and psychosis appeared to be an important and vibrant area for research.

My interest in the continuum approach to psychosis influenced my desire to carry out analogue research on a general population sample. Through reading the work of Craig Steel (e.g. Steel, Fowler & Holmes, 2005) as well as the psychological research on PTSD (e.g. Brewin et al., 2010), I selected to study the mechanisms underlying intrusive imagery and how these might theoretically influence psychotic experiences.

### **Underlying theoretical assumptions of the research**

The research process consisted of undertaking a literature review on hallucinations and mental imagery, as well as carrying out the aforementioned research on contextual processing, intrusive imagery and hallucination-proneness. Underpinning

the research were two theoretical assumptions: Firstly, the notion that psychotic experiences exist on a continuum throughout the population; secondly, that trauma is often a causal factor underpinning psychotic experiences. As such, experiences such as hallucinations and delusions are viewed as people's best attempts to understand their world and experiences of consciousness. Therefore, as these ideas sit in opposition to a medical, categorical approach to psychosis, the research takes a critical stance towards the diagnostic construct of schizophrenia and related psychotic disorders.

#### *The continuum approach to psychosis*

Both the literature review and the empirical research were situated within a continuum approach to psychosis and/or psychotic experiences. The continuum approach argues that psychotic experiences exist on a continuum from mild forms in the general population to clinical features that warrant intervention. More specifically, "schizotypy", "psychotic experiences" and "psychosis-proneness" are based on the view that the psychosis phenotype is expressed at levels well below its clinical manifestation. In a recent review of epidemiological studies, van Os et al. (2009) demonstrated that high proportions of individuals in the general population endorse symptoms akin to hallucinations and delusions. Further, the Dunedin cohort study (Poulten et al., 2000) found that adolescents frequently endorsed hallucinatory-type experiences.

Contrary to these findings, a latent categorical class has been demonstrated with regard to psychotic experiences (Horan et al., 2004; Linscott & van Os, 2010). That

is, there is some evidence suggesting a continuum and other evidence suggesting a discontinuous cut-off at the extreme end of the distribution. However, it has been pointed out that research investigating the epidemiology of psychosis is beset by methodical flaws (Linscott & van Os, 2010).

Despite the empirical research being situated within a “pure” continuum approach, the results provided some evidence (albeit post-hoc) to back-up the proposal of a discontinuous cut-off at the extreme end. Consequently, it may be that there exists an inherent vulnerability that makes some people more prone to a psychotic breakdown. Unlike theorists and clinicians who operate within a neo-Kraepelinian paradigm, this does not necessarily point to a vulnerability to schizophrenia, bipolar or psychosis per se. For example, a stress-reactivity vulnerability model has been proposed, whereby some people may be more prone to a heightened biological and psychological response to life stressors (Myin-Germeys & van Os, 2007).

Regardless of the evidence of either the continuum approach or a discontinuous cut-off theory of psychotic experiences, the dominant discourse is one situated within a categorical approach. Indeed, Linscott and van Os (2010) highlighted that, “there is a huge divide between findings formulated in contemporary theories of schizophrenia and the (nonevidence-based) way psychosis is conceptualised in DSM” (p.413). Consequently, this area of research is vital in order to affect institution and systematic change, in line with contemporary evidence.

Moreover, the difference between a categorical approach as advocated by the DSM and ICD as opposed to a continuous one, is crucially important. Accordingly, a latent categorical assumption can have dramatic implications for individuals diagnosed with a psychotic disorder. For example, clinicians operating within a categorical model may be more likely to ignore patients' preferences about treatment, sanction forced treatments, and trivialise contextual influences on an individual's experience (Bentall, 2009). Furthermore, a categorical (neo-Kraplinian) view has also been demonstrated to increase stigma, prejudice, fear and a desire for distance (Read et al., 2006). However, it has been argued that the lack of an alternative and the clinical utility of the existing categorical system, are strong reasons to maintain the current categorical approach (Lawrie et al., 2010).

In sum, investigating underlying assumptions of psychotic experiences is vitally important, as this can have dramatic effects on the treatment of those diagnosed with a psychotic disorder. The research process has highlighted the complexities of the continuum approach. In particular, despite initial assumptions of a "pure" continuum, it may be that there exists a cut-off at the extreme end. Consequently, continued research and discussion is important in order for contemporary empirical findings to affect clinical reality.

### *Trauma and psychosis*

There exists now a great deal of empirical evidence supporting the thesis that childhood traumatic experiences are a cause or contributing factor to the development of psychotic experiences (Read, Hammersley & Rudegeair, 2007). This

has created a paradigm shift and opened up new avenues for research and clinical interventions. Prior to this work, the life experiences of individuals diagnosed with a psychotic disorder were deemed irrelevant, as were the idiosyncratic meanings of psychotic experiences (Hammersley et al., 2007).

It is well known that traumatic experiences can result in intrusive re-experiencing of distinct moments of the trauma (Grey, Holmes & Brewin, 2001). Through the empirical research, I argued that the two information processing systems (allocentric and egocentric) involved in this, might exist on a continuum, with weaker allocentric capabilities resulting in hallucinatory-type intrusions. Drawing on an updated continuum of contextual integration hypothesis presented in the empirical paper, it is possible that continued traumatic events in childhood, such as childhood abuse or bullying at school, could continue to cumulatively weaken the allocentric processing system or the connections between the allocentric and egocentric processing systems. Consequently, this could result in a stream of intrusive, hallucinatory type material intruding into conscious awareness.

Interestingly, this hypothesis compliments some of the neurobiological findings in adults with a diagnosis of schizophrenia. The egocentric system is believed to be connected to body state and emotion areas, such as the insula and amygdala (Burgess et al., 2001; Byrne, Becker & Burgess, 2007), and the allocentric system is understood to be supported by the medial temporal lobe and hippocampus (Burgess et al., 2001; Byrne, Becker & Burgess, 2007). Accordingly, the updated continuum of contextual integration hypothesis would predict that individuals with a diagnosis

of schizophrenia would exhibit heightened amygdala and reduced hippocampal functioning. Congruent with these hypotheses, individuals with a diagnosis of schizophrenia have been demonstrated to exhibit hyper-activation of the hypothalamic-pituitary-adrenal (HPA) axis and reduced volume in the hippocampus (Walker & DiForio, 1997).

However, the empirical study also suggested that traumatic memories and trauma per se might be an important, but not altogether necessary condition for the development of intrusive imagery and hallucinations. Similarly, despite evidence for significant proportions of psychotic populations having experienced traumatic events, some have not. However, rather than “obvious” traumatic events, which people are able to recall, it may be that experiences of early care giving have similar psychological and neurobiological effects. Indeed, congruent with this hypothesis, it has been demonstrated that early care giving experiences (or lack of) have permanent effects on the stress response system of the developing brain (Gerhardt, 2004). That is, a baby who is often left to cry in pain may develop a heightened stress-response system.

In support, Read et al., (2001), presented a “traumagenic neurodevelopmental” model to describe how events early in life might affect the developing brain in terms of heightened stress sensitivity. As such, the authors argued that the diathesis in a diathesis-stress model of psychosis might be poor early care giving or traumatic experiences, rather than assumed biological or genetic vulnerabilities. In line with an updated continuum of contextual integration hypothesis, it would be predicted that

this would create the conditions for an intact or heightened egocentric system and weak allocentric processing system. Consequently, an individual would be highly sensitive to stress, and as such, even mild stressful events could create the conditions for hallucinatory type experiences. However, evidently with such a hypothesis, additional factors are likely to be involved. This is because many individuals with inadequate care giving experiences often progress to receive a diagnosis of non-psychotic disorders, such as borderline personality disorder, rather than psychosis (Fonagy et al., 2003).

Providing some support to the updated continuum of contextual integration hypothesis, the two participants who reported hearing voices on the predisposition to hallucination scale, also scored very poorly on the allocentric condition of the information processing task, and had very high scores on the intrusive imagery paradigm. In light of the above, it would be interesting to investigate the early care giving experiences of these participants, and/or their experiences of traumatic or stressful events throughout their life.

Nevertheless, the updated continuum of contextual integration hypothesis and some of the hypotheses presented above, highlight two strands of possible interventions for people distressed by psychotic experiences. Firstly, interventions drawing on trauma focussed cognitive therapy (Ehlers & Clark, 2000), which was demonstrated as effective in a single case study with a man with a diagnosis of schizophrenia (Morrison, 2004). This therapy could be employed for individuals whereby psychotic symptoms are related to traumatic experiences. However, the same intervention



might also be effective for psychotic experiences not related to traumatic incidents. For example, this could involve focussing on a malevolent voice and simultaneously providing a verbal narrative, which includes details of context. This might help to integrate the C-rep with the S-rep intrusion, thus reducing automatic retrieval. Secondly, running parallel with a trauma-focussed intervention could be a compassionate mind therapy (CMT), which was demonstrated as effective in reducing the frequency of malevolent voices (Mayhew & Gilbert, 2008). As such, CMT could help to reduce the activation of S-reps through self-soothing, whilst a trauma-focussed intervention could strengthen the C-reps, thus providing greater “top down” control.

In sum, despite initial assumptions of a link between trauma and psychosis, the research process has highlighted that although trauma is important and prevalent in psychotic populations, it may not be necessary for the development of psychotic experiences. However, similar information-processing systems and associated neuro-biological mechanisms might be involved in both types of psychotic experiences, thus indicating a rationale for employing trauma focussed cognitive therapy and compassionate mind therapy.

### **Practical and conceptual issues of measurement**

In some respects, the relationship between intrusive imagery and hallucinations might be argued to be tautological. Indeed, conceptually, both intrusive imagery and hallucinations have been argued to form part of the same construct. For example, Morrison (2001) argued that the difference between hallucinations and intrusive

imagery is in the interpretation. An example may be hearing a voice and interpreting it as the voice of an abuser, versus interpreting it as the voice of the devil. These interpretations of the same cognitive experience are likely to result in drastically different consequences and diagnoses by professionals. Similarly, the current empirical study was positioned within the assumption that a hallucination is on an extreme end of an intrusive imagery continuum. Accordingly, to tease apart these constructs within research paradigms is fraught with difficulties.

The literature review highlighted some of the difficulties that researchers have faced when trying to test the relationship between intrusive imagery and hallucinations. For example, Aleman, Bocker and de Haan (1999) argued against the use of introspective reports by demonstrating contradictory findings between “objective” and “subjective” measures of mental imagery. Further, Merkelbach and van de Ven (2001) demonstrated that for some individuals, responses on introspective reports might represent a response bias to endorse odd items.

The psychosis-proneness measures used in the empirical study were the LSHS-R (Bentall & Slade, 1985; Launay & Slade, 1981) and the O-LIFE(s) (Mason, Linney & Claridge, 2005). They are based on the assumption that hallucinatory and other psychotic experiences exist on a continuum within the general population (Claridge, 1987). Regarding hallucinatory experiences, one factor demonstrated to exist within the measures is vivid imagery/daydreams (Waters, Badcock & Maybery, 2003). However, empirical evidence has not reached a consensus that vivid volitional imagery is in any way related to hallucinatory experiences (Bentall, 1990).

Therefore, the measures may lack some construct validity with regard to assessing a “true” continuum of hallucinatory experiences. Similarly, another factor demonstrated to exist within the measures is intrusive imagery (Waters, Badcock & Maybery, 2003). Consequently, the measures may also lack sensitivity to differentiate between intrusive imagery and hallucinations.

In order to pragmatically move beyond these issues, some conceptual clarity is required. Indeed, Pierre (2009) suggested we have to be very careful when we “name names” (p. 1578). It is often assumed that because we call something a hallucination, then it is a hallucination, and that it is the same construct as something else that we call a hallucination. However, it has been established that hallucinations are not homogenous (Jones, 2010). Therefore, intrusive imagery might be on a continuum with one type of hallucination but unrelated to another type. For example, some researchers have proposed that hallucinations represent a form of inner speech (mis)attributed to an external source (Seal, Aleman & McGuire, 2004). Such inner speech might be related to one type of hallucination, whereas intrusive imagery might be related to another. Therefore, it would be important to clarify different types of hallucinations and how these relate to intrusive imagery.

With regard to future investigations in the area of intrusive imagery and hallucinations, if employing an analogue design, it might be more useful to screen for individuals who have had hallucinatory experiences. This would satisfy the literature regarding a discontinuous cut-off that may exist within the schizotypy continuum. Further, screening for hallucinatory experiences might allow for a more valid and

reliable method for investigating the relationship between hallucinatory experiences and intrusive imagery.

### **Summary and final reflections on the research process**

The research process has highlighted the conceptual complexity that is involved when developing and testing theories of psychological difficulties. As discussed, the research was positioned within an assumed continuum approach to psychotic experiences. However, the empirical study, in addition to findings from the literature, has demonstrated some evidence for a cut-off at the extreme end of a continuum. Consequently, investigating more extreme cases within an analogue paradigm might be warranted, as well as investigating factors that might underlie this cut-off. Certainly, continued thought and empirical research within this area is necessary due to the implications of a categorical approach.

Moreover, as discussed, preconceived ideas about the impact of trauma on psychosis have also shifted as a result of the research process. Traumatic experiences such as childhood sexual abuse have been demonstrated to be important and crucial factors in why many people become diagnosed as psychotic. However, it may be that similar outcomes can emerge from other psychosocial factors such as unresponsive early care giving, which has been demonstrated to have permanent effects on the stress-response system. As such, interventions such as trauma-focussed cognitive therapy and compassionate mind therapy might be helpful for individuals with distressing psychotic symptoms.

The third area of the critical appraisal concerned conceptual and practical issues related to measuring hallucinations and intrusive imagery. The importance of clarifying different types of hallucinations and how these relate to intrusive imagery was discussed. Further, employing an analogue design, screening for hallucinatory experiences might allow for a more valid and reliable method for investigating the relationship between hallucinatory experiences and intrusive imagery.

The research process has highlighted the importance of critiquing taken for granted conceptual and theoretic assumptions. I believe this questioning and reflexive stance is vital to the practice of a clinical psychologist within both clinical and research domains. Accordingly, Donovan (2003) highlights the importance of “stepping into the generic waters of uncertainty from time to time” (p.122). As such, the theoretical assumptions underpinning the empirical research, as well as the ideas presented in this critical appraisal, represent a pathway towards continued thought and research, rather than an endpoint.

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## **Appendices**

## **Appendix 1: Ethics approval**



Professor Chris Brewin  
Research Department of Clinical, Educational &  
Health Psychology  
University College London  
4<sup>th</sup> floor, 1-19 Torrington Place  
London  
WC1E 7HB

17 May 2010

Professor Brewin

**Notification of Ethical Approval:**

**Ethics Application: 2396/001: The relationship between contextual processing, intrusions and psychosis-proneness**

I am pleased to confirm that in my capacity as Chair of the UCL Research Ethics Committee I have approved your project for the duration of the study (i.e. until June 2011).

Approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form'.

The form identified above can be accessed by logging on to the ethics website homepage: <http://www.grad.ucl.ac.uk/ethics/> and clicking on the button marked 'Key Responsibilities of the Researcher Following Approval'.

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

**Reporting Non-Serious Adverse Events.**

For non-serious adverse events you will need to inform Dr Angela Poulter, Ethics Committee Administrator ([ethics@ucl.ac.uk](mailto:ethics@ucl.ac.uk)), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

**Reporting Serious Adverse Events**

The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an

independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

Yours sincerely

p.p. 

**Sir John Birch**  
**Chair of the UCL Research Ethics Committee**

Cc. Mr Daniel Glazer; Dr Oliver Mason, UCL Research Department of Clinical, Educational & Health Psychology

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## **Appendix 2: Participant information sheet**



## Information Sheet for Participants

### **Mental Imagery and Unusual Experiences**

This study has been approved by the UCL  
Research Ethics Committee [Project ID  
Number]:

**2396/001**

Name, Work Address and Contact  
Details of the Principal Researcher and  
Applicant

**Chris Brewin**  
**Professor of Clinical Psychology**  
**Dept. of Clinical, Educational and Health**  
**Psychology,**  
**University College London**  
**4<sup>th</sup> floor, 1-19 Torrington Place, WC1E 7HB**  
**020 7679 1897**  
**c.brewin@ucl.ac.uk**

You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important to read the following information carefully and discuss it with others if you wish. Please ask us if there is anything that is not clear or if you would like more information.

**We are recruiting adults between the ages of 18 and 65 to take part in a study looking at the way people process information and how this relates to mental imagery and unusual perceptual experiences. This research will inform our understanding of how the same process might be involved in psychological difficulties such as post-traumatic stress disorder and psychosis.**

**We hope that researching these processes will lead to a greater understanding and improved psychological treatments.**

**If you agree to take part you will be asked to visit the Research Department of Clinical, Health and Education Psychology, UCL for approximately 1.5 hours. You will be paid £10 for your time.**

**You will be asked to carry out a computer task that looks at information processing abilities. You will be asked some questions on your daily experience of mental imagery and there will also be some questionnaires to fill in that look at unusual experiences and mood.**

**Although unlikely, if you take part there is a risk that some of the questions you will be asked or filling in the questionnaires may result in some distress. If this distress continues and you would like additional support then we recommend you contact your GP or call the Samaritans on 08457 909090. Students of UCL can contact the student counselling service on 020 7679 1487.**

### **Appendix 3 : Consent form**

## Informed Consent Form

Please complete this form after you have read the Participant Information Sheet

Title of Project: **Mental Imagery and unusual experiences**

This study has been approved by the UCL Research Ethics Committee [Project ID Number: **2396/001**]

Thank you for your interest in taking part in this research. Before you agree to take part the person organising the research must explain the project to you.

If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

### Participant's Statement

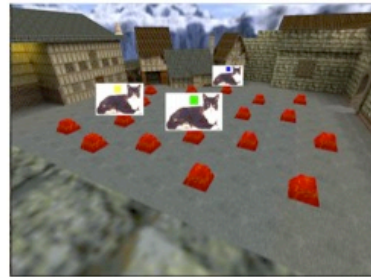
I .....

- Have read the notes written above and the Information Sheet, and understand what the study involves.
- I understand that if I decide at any time that I no longer wish to take part in this project, I can notify the researchers involved and withdraw immediately.
- I consent to the processing of my personal information for the purposes of this research study.
- I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.
- I agree that the research project named above has been explained to me to my satisfaction and I agree to take part in this study.

Signed:

Date:

#### **Appendix 4: Images of the VE task**



## **Appendix 5: Intrusive imagery interview schedule**

## **Intrusive Imagery Interview Schedule**

I'm going to ask you some questions on your experience of intrusive imagery. Intrusive images are images that automatically pop into your head. They may consist of memories from the past, represent a fantasy about the future or just be an imaginary scene. Unlike normal thoughts and images that we may conjure up, intrusive images automatically pop into our head. Do you have any questions? Do you understand?

Can you report any spontaneous intrusive images that have automatically appeared into your mind during the past week? (if no, what about during a typical week?).

We are going to explore two of the most frequent intrusions. Can you briefly describe these:

- 1.
- 2.

Do these intrusions relate to a memory of an event?

If so can you describe the events?

### **Intrusion 1.**

1. How many times over the past week did it occur?
2. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image made you feel sad.
3. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image made you feel happy.
4. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image made you feel guilty.
5. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image made you feel ashamed.
6. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image made you feel angry.
7. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image made you feel anxious.

8. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image made you feel helpless.
9. Rate from 0 (very hazy) to 100 (very clear and vivid) how vivid the intrusive image was.
10. Rate from 0 (not at all) to 100 (very much so) the sense of “nowness” of the intrusive image. (nowness = the extent to which it felt like the image/scene was actually happening in the present)
11. Rate from 0 (not at all) to 100 (very much so) the impact the intrusive image had on daily activities.
12. Rate from 0 (not at all) to 100 (very much so) how uncontrollable the intrusive image was.
13. Rate from 0 (not at all) to 100 (very much so) how much distress the intrusive image caused.
14. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image contained smells
15. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image contained tastes.
16. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image contained sounds.
17. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image contained tactile sensations
18. Rate from 0 (not at all) to 100 (very much so) the extent to which this intrusive image contained visual elements.

Repeat qu's 1-18 for the second intrusive image